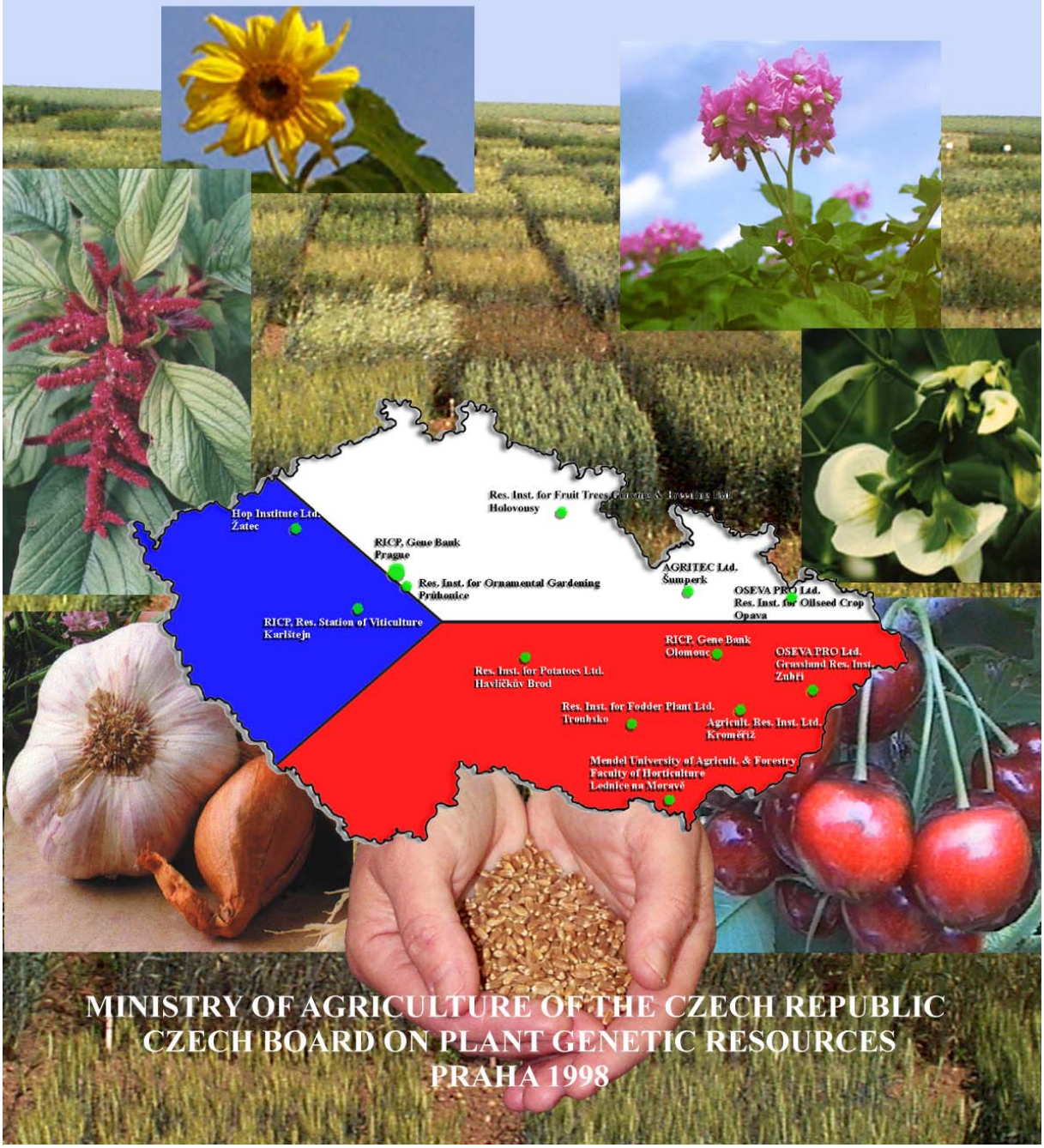
NATIONAL PROGRAMME ON PLANT GENETIC RESOURCES CONSERVATION AND UTILISATION IN THE CZECH REPUBLIC



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CZECH BOARD ON PLANT GENETIC RESOURCES
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Ministry of Agriculture of the Czech Republic
Czech Board on Plant Genetic Resources
Research Institute of Crop Production, Praha – Ruzyně

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HISTORY OF GENETIC RESOURCES STUDIES IN THE CZECH REPUBLIC

I. BAREŠ, L. DOTLAČIL

Various research and breeding stations in Czech Lands have been gathering cultivars since the beginning of this century. Collections of a wider range of species were gathered in three institutions:

- Agricultural-Botanical Research Station, Tábor (founded in 1880; abolished in 1919), where barley was tested since 1899 and wheat and other crops since 1903.

- The Chemical Physiological Research Station of the Czech Technical High School in Jeneč near Praha (founded in 1898) tested various species and cultivars. In 1920 it was moved to the Experimental Farm Uhříněves, which belonged to the newly founded Agricultural Research Institutes in Praha. This Experimental Farm also took over the collections of the abolished Agricultural Botanical Research Station, Tábor. In 1948 this institution moved to Doksany, and in 1952 to the newly established Research Institute of Crop Production, Praha-Ruzyně (RICP). At that time the collection of the Institute consisted of 2,847 cultivars of cereals, legumes, oil crops and partly fodder crops.

- The Moravian Land Research Institutes in Brno were founded in 1919 and, like the State Agricultural Research Institutes in Praha, it stressed gathering and utilization of landraces (through advertising and publicity, mainly in the 1930s). Similarly, the Moravian Land Institute for Crop Improvement in Přerov was very active (acclimatization experiments, including introductions, later also breeding). A large flax collection was assembled during World War II at the Research Station for Fibre Crops at Šumperk-Temenice.

Collections of the Moravian Institutes were moved to newly founded institutions, mainly to the Cereal Research Institute, Kroměříž; Research Institute for Fodder Plants, Troubsko; and Research Station for Grasses, Rožnov in the years 1951-1954.

In the collections of the above institutes, old landraces and obsolete cultivars from the beginning of the century have been saved. From the same period, obsolete cultivars of grapevine have been saved at the Research Institute for Viticulture and Enology, Bratislava, and of fruits and ornamental plants in the old plantations held or documented in research institutes.

From the 1930s on, original domestic and foreign cultivars of other agricultural crops were maintained at pre-war research and breeding stations. They were at various levels of breeding since they were introduced to the cultivation practices of that time.

In a wider scale of species, due to a good level of breeding, the oldest original Czech cultivars are represented as selections (in form of lines, strains) from landraces (wheat, barley, oats, legumes, flax, hop, self-pollinating fodder crops and vegetables), or as populations (maize, oil crops, fodder crops, vegetables and ornamental plans). The greater part, however, are Czech cultivars that originated by combination crosses. The collection of Czech origin reaches 4.000 cultivars in the Gene Bank of RICP (1996).

A systematic study was possible on a large scale since 1951, when many specialized research institutes were created. Up to 1990, 25 research institutions were linked in the maintenance of collections, with the Research Institute of Crop Production, Praha (RICP), serving as national coordinator. Later, a cooperation in the frame of COMECON countries (1971-1990) and EUCARPIA, FAO, IBPGR/IPGRI and ECP/GR has evolved.

To coordinate all efforts, a National Board on Plant Genetic Resources was created already in 1955. Since the 1960s, studies were done in the independent genetic resources departments of all institutions, which enabled larger-scale studies on a very good level. The main points of the project were published in the ”Framework Methodology" that appeared in 5-year intervals at RICP Praha.

The range of 6,000 cultivars (half of them at RICP Praha) gathered in Czechoslovakia in 1951 (the year RICP Praha was founded) was subsequently enlarged to 43.106 accessions without duplications in

1988 (Tables 1 and 2) and 54.000 accessions with duplications (since more important crops were kept at two or three locations). Due to thorough revisions of the collections, the number of accessions was decreased to 37.865 (1992) by correction of passport data and exclusion of non-viable items. A further decrease of numbers of accessions was caused by the creation of the Slovak Republic, when duplicates and other collections like maize, thermopile legumes, vegetables and grapevine were separated. The present state of the Czech collection reached 43.500 items without duplications in 1998.

Tab. 1. Increase of collections in former Czechoslovakia

Year	Number of Accessions
1951	6 000
1960	18 000
1970	35 000
1980	40 000
1988	43 000
1992	37 854

Tab. 2. List of collections present in former Czechoslovakia by the end of 1988 (excluding duplications)

Crop (group of crops)	Number of Accessions
Cereals	15 058
Maize	1 643
Legumes	2 423
Oil plants	664
Fibre plants	1 898
Root crops	236
Potatoes	724
Fodder crops	2 322
Hop	239
Tobacco	200
Vegetables, aromatic plants	8 500
Fruit crops	2 736
Grapevine	1 733
Tropical and subtropical crops	80
Ornamental plants	4 350
Collections of different crops in the State Institute for Testing and Control	300
TOTAL	43 106

At RICP Praha, collections of all species, including small grain cereals, buckwheat, oil crops, legumes and selected vegetable species were maintained since 1951. Up to 1964, when Department for Plant Genetic Resources was founded, the collections had been moved to specialized institutes, where their extent and evaluation had been significantly increased. At RICP Praha a wheat collection, winter barley, and several species of vegetables were let, and early cultivars of grapevine at the Experimental Station for Viticulture, Karlštejn. Those are the species on which additional studies were conducted, such as genetics or plant breeding methods, under the Institute research projects.

Due to difficulties to establish and keep contacts abroad under the former political regime, there was a need for a centralized system to import new advanced cultivars from all over the world, especially from developed countries of Europe. In the past, the international company KOOSPOL - for western countries - or the Central Agricultural Control and Testing Institute (CACTI) - for COMECON countries - used to purchase such introductions, while the Ministry of Agriculture provided the funds for the purchases. These imports contributed most to the increase of collections, 60 to 80 % (i.e. 1.500 - 2.000 accessions annually) of the total increase up 1989. The availability of genetic resources from collections of former COMECON

countries was also possible through contacts and organized cooperation with the Research-Technical Board for Collections of Cultivated Plants at the All-Union Institute for Plant Production (VIR) in St. Petersburg. Summaries of the imports were provided as computer-generated publications since 1976. A regularly published Index Seminum served as a primary offer for international exchange. There were ten editions, starting with 15,000 items in 1956, to 35,000 in 1987; recently, specialized catalogues have been published. In the 1980s, a wide range of expeditions was organized under the cooperation with COMECON countries and later independently (Caucasus, Central Asia, Mongolia, Turkey, Northwest China, Kamchatka, Czechoslovakia and adjacent countries).

In the late 1960s an information system of genetic resources was started - at first by national standardization of scoring scales, using a numeric one digit system 1 to 9 which we managed to set up even in the frame of COMECON. National descriptor lists for different species were developed (1969-1973), and further standardizations within COMECON countries were put into effect (1974-1986). Simultaneously updated national versions were published (1976-1992) for the most important species. Subsequently, the national germplasm information system EVIGEZ was worked out (since 1976), with a wider range of passport data (especially since 1988) and with further limited evaluation data, which is still going on. The first larger evaluations were done as early as 1969-1970 (60 criteria of 340 wheat accessions).

A great effort was devoted to conservation of collections. Therefore, a method of cultivar rejuvenation by sowing in several years' cycles according to viability of a species, and to the need for isolation of out-crossing species was improved to optimize the storage method in unclimatized stores. Since 1976, long-term climatized storage in recommended temperature regimes had begun, so that 5.000 accessions were already stored in freezing chambers by the end of the 1980s. Since 1981, a research program for long-term storage has been started at RICP Praha and a method for climatized seed storage in Czechoslovakia, including the necessary documentation, has been proposed. In 1988, the building of the Gene Bank at RICP Praha was finished, including laboratories, with a total capacity to store 100,000 accessions under one of two possible regimes (long-term and very long-term storage). Since that year the Gene Bank has been gradually filled with the cooperation of collaborating institutions that maintain seed propagated species.

Genetic resources studies in Czechoslovakia were concentrated on testing for the most important biological characters with a view for effective economic and breeding use. The evaluation required large-scale experiments, which were possible due to a sufficient capacity of specialized institutes. Experiments on 70-80 ha (1/2 of orchards and vineyards) with 10-14.000 cultivars were performed annually. A further 6-

8.000 accessions were sown for maintenance (according to species in different kinds of isolation); the same number of evaluated resources was distributed for breeding use.

With cooperation of CACTI, a fast introduction of foreign **c**ultivars was assured so that an assortment of cultivars has been completed by more productive cultivars with a better quality. In 1956-1974, the introduction of tens of cultivars was facilitated, especially legumes and cereals. After that period, foreign breeders, or their agents in Czechoslovakia or the Czech Republic also offered cultivars. Long-term genetic resource studies and cooperation in breeding was significantly responsible for the good properties of Czech registered cultivars in the beginning the 1970s, which in turn caused a decrease in the introduction of foreign cultivars. This cooperation resulted even in co-authorship of curators of germplasm collections in many Czech cultivars.

GENEPOOL OF AGRICULTURAL CROPS AND ITS VALUE
NATIONAL PROGRAMMEME ON PLANT GENETIC RESOURCES CONSERVATION AND UTILIZATION IN THE CZECH REPUBLIC

L. DOTLAČIL

Soil, water and air traditionally are considered basic sources for the existence and development of mankind. The need to protect and maintain these resources has become an acknowledged fact, although man`s behavior does not always respect this knowledge. Beside these resources, a fourth basic resource for development of Life on Earth exists - this is germplasm, characterized by self-reproduction, inheritance of characters and development. Complex of living organisms can be indicated as biodiversity. Increasing attention is paid to this basic resource on both national and international levels because of its value and importance but also the danger of losses and/or damage to it (genetic erosion).

The term ”biodiversity” covers all existing differences among living organisms on Earth. It is estimated that about $5\text{-}10x10^6$ species of living organisms exist, many of which may consist of millions or billions of genetically distinct individuals. Up to now, over 1,7 million species have been identified and described. Plants represent 14 % of this number.

Plants form the basis of life on Earth and for the survival of mankind. Thanks to the process of photosynthesis, they are able to utilize solar energy, fix CO_2 and produce oxygen. In this way, the vegetation conditions basic processes in the biosphere, it provides food, raw materials and energy for man and fodder for animals. About 5,000 plant species are of crucial importance for man`s nutrition and other needs. Even though this is a tiny part of the existing biodiversity, the genetic diversity within this small group of plant species has an extraordinary impact. Through natural evolution, and later also by breeding, a huge genetic diversity has appeared particularly in the important species of agricultural crops. This diversity became a unique and irreplaceable source for further genetic improvement of crops, i.e. by breeding.

The genetic diversity existing within particular agricultural crops (genepool) is gathered by research and breeding institutions of all countries in so-called ”collections of plant genetic resources”. Usually bred registered or restricted cultivars, landraces, primitive cultivars, experimental lines (carrying significant genes) as well as wild relatives of cultivated plants are gathered in collections. Genes and gene complexes, which originate from these genetic resources, are used in the breeding of new, better adapted cultivars, with higher yield and better quality of products and tolerance or resistance to stresses or pests.

Today, the existing diversity of plant genetic resources is seriously endangered. In nature, biodiversity has been reduced due to industrial development, climatic changes and some agricultural practices. The biodiversity of crops in agricultural systems has also been decreased. During the last century - and especially during the last 40-50 years - the diversity of local and well-adapted landraces has been replaced by a much narrower spectrum of bred cultivars that are often genetically rather similar. In many cases, valuable and irreplaceable resources were lost.

Genetic diversity is of immense value for present and future generations of people; therefore, it is an urgent task to maintain it. To reach this goal all relevant methods of conservation of plant genetic resources should be implemented [that is protection of natural habitats, maintenance of seed samples in gene banks and vegetatively propagated species in field collections (or in tissue culture), and conservation of plant genetic resources by growing in agricultural practice (”on farm” conservation)]; to maintain all information on these plant genetic resources is also important.

Besides conservation of plant genetic resources for the needs of future generations it is necessary to assure their effective utilization in present breeding. While agriculture has developed rapidly in last decades, many of its practices and methods used hitherto can hardly be applied in sustainable agriculture. At the same time, one of the principles of sustainable development in agriculture is a more effective use of genepools. Cultivars grown should have sufficient resistance (tolerance) to both biotic and abiotic stresses, with high and stable yield, good quality of the products, and with efficient response to fertilizers; they should do so even with lower inputs of agrochemicals. Widening of diversity of cultivars and crops to achieve a better stability of the whole agroecosystem will have the equal importance. To meet this demand, a sufficiently broad range of suitable crops and cultivars has to be available for agricultural practice.

Furthermore, since this diversity will also contribute to social stability (food, income of rural societies, employment) and to the quality of the environment; it will obviously become one of the factors influencing the quality of life of people.

The importance of plant genetic resources and biodiversity in general is acknowledged through the increasing international attention drawn to these topics, and by concrete forms of international cooperation. The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992, became a world summit for this cooperation. Agenda 21, an important part of the conference, summarized on 800 pages the proposals of particular countries aimed at maintenance of genetic resources and their utilization for sustainable development. In the preamble of Agenda 21 it states: ”Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environmental and developmental concerns and greater attention to them will lead to the fulfillment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own, but together we can - in a global partnership for sustainable development”.

The Food and Agriculture Organization (FAO) of the United Nations is an important institution which deals with plant genetic resources conservation and utilization in agriculture. One of the tasks of FAO is to create and develop an international network of agreements, mechanisms and tools, which should support conservation and utilization of plant genetic resources on a global level. E.g. the FAO organizes the International Network of Base Collections, Early Warning System on Plant Genetic Resources and other activities. FAO coordinates the ”Global Plan of Actions” (1996) aimed at global network of activities to save, conserve and utilize plant genetic resources.

The International Plant Genetic Resources Institute (IPGRI) in Rome is another key organization with a global mandate, which is involved in a coordination of international cooperation on plant genetic resources conservation and utilization. This institute has close links to FAO, its activities are (besides others) oriented on projects in particular regions. For Europe, the European Cooperative Program on Plant Genetic Resources (ECP/GR) was launched in 1980, and former Czechoslovakia joined this Program in 1983. Only a few small European countries do not participate in ECP/GR presently.

Study, conservation and utilization of genetic resources have been recognized as priorities in agriculture and in general for biological research. Care about genetic resources is not only one of the preconditions for sustainable development. It is also an obligation of every civilized country of the world community. Due to the global character of existence and maintenance of genetic diversity, it is necessary to undertake and coordinate a range of actions on both global and regional levels. We should all contribute to an effective participation of the Czech Republic in these efforts.

There are good preconditions for successful work on genetic resources of cultivated plants in the Czech Republic. There exist a long-term tradition and skilled specialists. An operational information system on plant genetic resources (EVIGEZ) is available, as is the national gene bank for conservation of all seed-propagated collections, with technology that meets international standards. A crisis in plant genetic resource study and conservation came in the early 1990`s due to deep cuts in the budget for agricultural research, privatization (or the abolishment) of institutes holding collections, and through the division of former Czechoslovakia into the Czech and Slovak Republics. These unfavorable circumstances have been overcome by the decision of the Ministry of Agriculture of the Czech Republic in 1993 to launch the ”National Programme on Plant Genetic Resources Conservation and Utilization”. This project covers all basic activities on plant genetic resources, namely gathering (including collecting missions), documentation, evaluation, conservation and services to users. Presently, 10 institutions in the Czech Republic are involved in the National Programme, among them two state research institutes, one agricultural university and seven private undertakings that perform agricultural research. The project is coordinated by the Gene Bank at RICP Praha, while expertise and consultations are provided by the Czech Board on Plant Genetic Resources, in which staff of the Ministry of Agriculture, Gene Bank, curators of collections, breeders and other specialists are members.

The institutions holding collections are responsible for the maintenance and increase of collections (in cooperation with the gene bank), documentation, evaluation and regeneration of genetic resources. In vegetatively propagated species, the institutes holding these collections are in the position of a gene bank. They are responsible for long-term conservation of plant genetic resources (usually in field collections; in

potatoes this method is combined with ”in vitro” maintenance). The Gene Bank at RICP Praha provides long-term storage of seed samples of seed propagated species as well as operation of the National Information System on Plant Genetic Resources (EVIGEZ) for all cooperating institutions. All workplaces have close partnerships with users within the country and also abroad. Surveys of the organizational structure of the ”National Programme...” and of cooperating institutions with their main activities are briefly characterized in enclosed Table 1. All workplaces involved in the National Programme are introduced in separate chapters in this booklet.

For the needs of curators of collections and workers of the Gene Bank, the "Framework Methodology of the National Programme...” has been prepared, which is regularly updated in 3-4 year intervals (last issue 1995). In connection with the Framework Methodology ”Working Methods” have been developed for particular collections and services of the Gene Bank (long-term storage, information system EVIGEZ). The following goals and main tasks of the National Programme have been formulated.

1. Long-term conservation of plant genetic resources for future needs.

2. Gathering (including collecting missions), evaluation, documentation and long-term maintenance (in both active and base collections) of indigenous plant genetic resources.

3. Systematic and concentrated effort to increase collections that meets the needs of local breeders and researchers and the gathering of broad genetic diversity.

4. Systematic evaluation and study of collections, aimed at the choice of suitable donors of important characters.

5. Documentation of plant genetic resources, creation of standardized databases including passport and evaluation data with possibility of international exchange.

6. Widening of the spectrum of collections with new crops in coordination with the needs of farmers and breeders.

7. Gathering knowledge on crop diversity and broadening the existing diversity of both crops and cultivars in plant production.

8. Access to plant genetic resources and relevant information for users within the country and abroad.

Detailed information on particular workplaces and their activities within the National Programme can be found in separate chapters of this booklet.

Institutions involved in the "National Programmeme ..." and their responsibilities and activities

Institution, location	Responsibilities, activities, number of accessions in collections
1. Research Institute of Crop production (RICP) Drnovská 507 161 06 Praha – Ruzyně	Seed Gene Bank; long-term storage of all seed-propagated collections as active collection and selected valuable accessions also as duplication in base collection National information system on PGR Coordination of the "National Programme...." and coordination of international cooperation
1.1.RICP - Dept. of Gene Bank 161 06 Praha – Ruzyně Tel.: + 420 2 33022111 Fax: + 420 2 33022286 S	Collections of wheat (including wild species), winter barley, triticale, buck wheat, millet, sorghum, maize, beet, *Amaranthus,* and other alternative crops and catch crops IC - sunflower IDB - wheat In collections 14 050 accessions
1.2.RICP – Dept. of Gene Bank Workplace Olomouc Šlechtitelů 11 783 71 Olomouc-Holice Tel. + Fax: +420 68 5228355 S	Vegetables; spice, aromatic and medicinal plants FGB - vegetatively propagated species IC - vegetatively propagated *Allium* sp. In collections 8 374 accessions
1.3.RICP – workplace Karlštejn, Research Station of Viticulture 267 18 Karlštejn Tel.: + 420 311 684 131 S	Grapevine (part of collection) FGB - grapevine In collection 246 accessions (+another 286 accessions are maintained in cooperation with Breeding Station Vrbovec)
2. Agricultural Research Institute Ltd., Kroměříž Havlíčkova 2787 756 41 Kroměříž Tel.: + 420 634 426111 Fax: + 420 634 22725 P	Spring barley, oats, rye (working collection of wheat) In collections 5 055 accessions
3. AGRITEC, Ltd. Šumperk Zemědělská 16 787 12 Šumperk Tel.: + 420 649 382 111 Fax: + 420 649 382 999 P	Pea, vetch, broad bean, lupine, flax and other legumes and fiber crops IDB - flax In collections 4 341 accessions
4. OSEVA PRO Ltd.	
4.1. OSEVA PRO Ltd., Grassland Research Institute 756 54 Zubří 698 Tel.: + 420 651 583195-6 Fax: + 420 651 583197 P	Grasses including wild ecotypes, phytocenoses of flowering meadows IDB - *Trisetum flavescens, Arrhenatherum elatius* In collections 1 747 accessions
4.2. OSEVA PRO Ltd. Research Institute for Oilseed Crops Purkyňova 6 746 01 Opava, Tel.: + 420 653 216 560 Fax: + 420 653 216 742 P	Rape seed, mustard, poppy, other oilseed crops In collections 1 020 accessions

5. Research and Breeding Institute of Pomology, Ltd. 507 51 Holovousy Tel.: + 420 435 92121 Fax: + 420 435 924 33 P	Cherries, sour cherries, plums, apples, pears, berries and other fruit trees FGB - vegetatively propagated fruit trees and bushes In collections 2 199 accessions
6. Mendel University of Agriculture And Forestry, Brno; Faculty of Horticulture 691 44 Lednice na Moravě Tel.: + 420 627 98 210 Fax: + 420 627 98 411 S	Apricots, peaches, almonds, grape- vine (part of collection); selected perennial vegetables and ornamental plants FGB - vegetatively propagated fruit trees and grapevine, perennial vegetables In collections 1 650 accessions
7. Research Institute for Fodder Plants, Ltd. Zahradní 1 664 41 Troubsko Tel.: + 420 5 43210145 Fax: + 420 5 321529 P	Alfalfa, clovers, other fodder plants (including perspective wild forms) In collections 1 486 accessions
8. Research Institute for Potatoes, Ltd. Dobrovského 2366 580 03 Havlíčkův Brod Tel: + 420451 323 Fax: + 420 451 21578 P	Potatoes (including wild and related species) *In vitro* collection In collections 1 465 accessions
9. Hop Institute Ltd. Kadaňská 2525 438 36 Žatec Tel.: +420 397 2061 Fax: +420 397 2064 P	Hop FGB – field collection In collection 289 accessions
10. Research Institute for Ornamental Gardening 252 43 Průhonice Tel.: + 420 2 267750027 Fax: + 420 2 267750023 S	Ornamental plants FGB - vegetatively propagated species of ornamental plants In collections 1 490 accessions

P - private company
IC - international collection
FGB - field gene bank
S - state - owned institution
IDB - international data base

DOCUMENTATION SYSTEM

I. FABEROVÁ

History

Documentation of plant genetic resources has a long tradition at the Research Institute of Crop Production (RICP) in Praha. Systematic data gathering began in the sixties, especially for the wheat collection, which was held in the department of genetic resources. At that time a large amount of information was stored on paper. It was necessary to start mass-processing the data. The first step was mechanical sorting of punch-cards.

RICP Praha was acting as a central importer of plant genetic resources from abroad for specialized crop institutions in the former Czechoslovakia. Documentation of imported material has required a lot of administrative work. Several thousand accessions were distributed to 30 institutions every year.

In the mid-1970s a computerization of data began, even though there was no computer equipment available at RICP, but it was possible to work on the computer at the Physical Institute of the Academy of Sciences. In the mid-1980s the Institute obtained an Apple IIe computer from IBPGR, Rome. The EVIGEZ information system was established in the early eighties. Its name comes from abbreviation of the Czech term for the documentation of genetic resources (”EVIdence GEnetických Zdrojů”). The passport data have represented a basic part of this documentation system, and it was working under the software Informix and the operation system Unix in the Physical Institute. At the same time the documentation of introduced material was running on the Apple computer under a special program.

By the end of the 1980s, all documentation was done on computer equipment owned by RICP. At the end of 1988, the building of the gene bank was finished, and the following year the documentation routine under software dBase III Plus started. The EVIGEZ user program has been working under relational database software FoxPro since the early 1990s, and it has been developed according to the requirements of PGR users. Today, it is working under the software FoxPro2.5.

EVIGEZ user program

The special user program EVIGEZ has been developed for work with plant genetic resources collections in Czechoslovakia. Its usability has been tested not only at the gene bank Praha but also at all collaborating institutions. Its advantages are simplicity and utilization of the national environment. It consists of three parts: passport, characterization/evaluation, and storage documentation. These three parts are interconnected in the user program.

Passport part

The national accession number is assigned to the genetic resource as the unique identifier. The accession number, in a key field is the first step to include an accession into the documentation system. Collection curators assign the national accession number to the sample according to set rules. The national accession number consists of a code of the holding institution, crop code and the serial number of the accession within the crop collection.

The passport part includes the main characteristics of the genetic resource: taxonomy, cultivar name, country of origin, status of sample, year of including into collection, breeder and institution etc. Altogether, 33 passport descriptors contain information on wild material received from collection missions such as the collector’s name, expedition name, collection number, geographic data and description of the collection site. All additional passport information is included in the table ”Notes”. Many passport data are coded and all necessary coding tables are incorporated in the passport part. The passport part is well designed concerning data input, options and variable outputs. An user can take advantage of creating and printing of various reports, lists and labels.

Characterization and evaluation part

In the characterization and evaluation part, the results of detailed evaluation of all other characteristics are included. In contrast to the passport descriptor set with its universal usability, characterization and evaluation descriptors are specific for genera. All characterization and evaluation data

are coded on a scale 1 – 9, according to descriptor lists, i.e. specific list of descriptors for the genus with the rules for scoring the manifestation of each trait. Altogether 20 national descriptor lists have been prepared for the evaluation of genetic resources. These national descriptor lists were developed in collaboration with collection curators on the base of international IBPGR/IPGRI and COMECON descriptor lists, with addition of regional-specific characters. Sets up to 110 descriptors include morphological, biological, biochemical, cytological and yield data.

Such detailed information on plant genetic resources is what a user requires most. However, the evaluation and characterization data are mostly on paper only, in field books. Computerization of these data is a very time-consuming process, so that only a small part of them is so far available in electronic form. The characterization and evaluation part is connected with the passport part via the accession number. A basic file with the characterization and evaluation data is completed with descriptor lists and other coding tables.

Storage part

Information on storage documentation is contained in the third part of the EVIGEZ system. It consists of three storage files. Besides the accession number there is the acquisition number, the code for the location of the accession in storage, germination ability, moisture content, amount of seeds in the container. The storage date of each sample is entered. Also documented is how much, when and to whom parts of the sample have been distributed. All other data are available in the passport part via accession number. Each sample stored in the gene bank should have an accession number, which is assigned by the collection curator. The storage part has no special coding tables, because the data are not coded. Acronyms (special abbreviations used for the recipient) use the same coding table as the passport part for donor and breeder institution.

Utilization of EVIGEZ

Until 1994, the user program EVIGEZ was used at RICP Praha and RICP Piešťany. Since last year, it has been used at all 10 crop institutions that collaborate with the National Programme on Conservation and Utilization of Plant Genetic Resources in the Czech Republic. All institutions use the same programs and coding tables. The data are divided according to sphere of interest, and each collection curator has passport, characterization and evaluation data on the computer and/or additional data of related material held at other institutions. For the seed propagated collection, there are storage data of the curators own material stored in long-term or medium-term storage in the gene bank RICP. All data are available in the central documentation of the gene bank RICP. The data are updated once or twice a year (depending on collection type) in the central documentation and in crop institutions as well. Coding tables are updated regularly in collaboration with collection curators. The program part has been improved in accordance with user requirements. Despite the fact that the documentation system EVIGEZ was proposed and developed especially for the documentation of plant genetic resources in Czechoslovakia, there are many possibilities to update the program or add any other PGR information into the system. In the near future, the documentation will be enlarged with data on the method of cryopreservation or in vitro maintenance. Selected sets of accessions would be supplemented with image documentation. Data about the institutions own storage could be added to the storage part documentation. Curators will have a survey of the storage of both gene bank and institutions at their disposal. If the facilities at crop institutions have the conditions for medium-term or, better, long-term storage, they can work as a safe duplication to the gene bank collection.

The EVIGEZ documentation system is advantageous because of the good interconnection of all three main working areas: passport, characterization/evaluation and storage parts. Its base and principles were well conceived and with foresight. Profiting from the construction of descriptor lists published by IBPGR/IPGRI and COMECON, it is possible to use the main EVIGEZ tables in international data exchange. When international databases of various crops were developed recently, the Czech data were included in most of them. Thus, thanks to the good level of PGR data documentation, hardware and software equipment, the Czech Republic takes a satisfactory position in this field in Europe.

RICP Praha shares together with GEVES France the responsibility for the European Wheat Database (EWDB). EWDB was established in March 1996 in the framework of ECP/GR. The European Wheat Database home page has been held on the RICP server and it is on-line searchable, since June 1998.

COLLECTING AND EXPEDITION ACTIVITY IN THE CZECH REPUBLIC AND ABROAD

V. HOLUBEC

During millions of years of evolution, a tremendous richness of plant species and populations has developed in nature. From this diversity, man has chosen and is still choosing plants for his use, for breeding and cultivation. These genetic resources are now quickly disappearing from the contemporary landscape in nature. Due to modern large-scale agriculture, traditional regional crops, landraces and obsolete cultivars are also disappearing. Yet they are a heritage from generations of farmers and breeders. They are adapted to local climatic and environmental conditions, having usually a large diversity of genes and gene complexes. They usually form mixed populations. The genetic richness of crops and wild relative species of cultivated plants must be collected, maintained and studied.

In the past, research projects in the field of genetic resources were long-term oriented on large-scale testing of new domestic and especially foreign cultivars and on recommendation of promising materials for breeding. Collecting wild species was often based on a personal initiative of collection holders. There was also insufficient attention paid to the maintenance of landraces. Often, the collected material was not appropriately recorded. As a result, domestic landraces represented only 1.5 % and domestic wild relatives only 0.5 % of the whole number of germplasm documented in the germplasm information system EVIGEZ in 1991.

Due to the large network of agricultural research institutes founded in the1950s and 60s, current advanced and also some obsolete cultivars and landraces of the main crops were assembled in so called assortments. These have been saved in the germplasm collections to a major extent up to now. Many types of formerly less frequent crops with small areas of cultivation are no longer cultivated at all. Some of them can be found in collections of old breeding stations, in private gardens with traditional crops and herbs, in old orchards and abandoned gardens and in gene banks and germplasm collections of neighboring countries. The most promising localities to look for them are remote places with old settlements in the mountainous border regions.

KÜHN and TEMPÍR studied and collected traditional crops in Czechoslovakia since the 1960s, especially in the Carpathians. Later KÜHN guided three German expeditions from the Institut für Genetik und Pflanzenforschung, Gatersleben, to the Carpathians. These collections are partly maintained at Gatersleben, Agricultural University Brno, and the Gene Bank of RICP, Praha-Ruzyně.

Wild relatives of domestic origin were widely used for breeding of fodder plants at the Research Station for Grasses Rožnov since the 1930s. Many cultivars originated from ecotypes collected in the mountains near the Station, especially in the Moravskoslezské Beskydy. Similarly, several cultivars of leguminous fodder plants originated from ecotypes collected in Moravia near the Research Institute for Fodder Plants Troubsko (*Coronilla, Lotus*). Beginning in the 1950s, VACEK, and in the 1980s together with ZAPLETALOVÁ, organized collecting missions mostly in south Moravia, but also in the Českomoravská vysočina and Beskydy. Between 1990-1991, ŘEPKA was engaged in collecting. He collected 161 samples during 10 short trips.

In 1990, a joint expedition of RICP-s Praha and Piešťany (KÜHN, HOLUBEC, HAUPTVOGEL and others) was undertaken to the Carpathians on the Slovak-Moravian border. Over 80 samples of cereals and fodder crops were collected. The expedition succeeded in collecting three samples of local *Triticum dicoccon,* which had not been cultivated for three to ten years, respectively, and this was probably the last chance to save them. Two of these wheats were already collected originally by KÜHN and the German expedition.

HOLUBEC and KÜHN (1991) investigated localities of *Aegilops* in Slovakia. They gathered *Aegilops cylindrica* in an old grapevine plantation and on alluvial deposits of the Danube River in the Burda Mts., South Slovakia, in 1989. This locality can be considered as the most northern, original distribution of this species. Another *Aegilops* locality which HOLUBEC confirmed is around a silo for cereals in Dobré near the border- crossing to Ukraine, Čierna nad Tisou.

Vegetables, aromatic plants and spices, including some existing landraces, were collected by several expeditions organized by the Research Institute for Vegetables, Olomouc, by HAVRÁNEK and DUŠEK since the late 1980s. These crops are still occasionally present in some private gardens, especially in mountainous regions.

Landraces and old cultivars of fruit trees are very rarely planted nowadays and disappear when old gardens, alleys and solitary trees in the landscape are cut down. Their origin is mostly not known; they likely originated spontaneously and were used and distributed due to their qualities. Such material was studied by KOHOUT and TETERA. During the last 5 years, some of these landraces were collected by the Research and Breeding Institute for Fruits, Holovousy (RBIF). PAPRŠTEIN, together with retired pomologists, inspected a wide range of old orchards and several free-land museums, determined the trees during fruiting, and later collected grafts for their grafting in the nursery of RBIF Holovousy.

Staff from the Gene Bank RICP Praha and fodder- or vegetable-oriented institutes also participated in many international expeditions at home and abroad (Table 2). The expedition missions in the 1980s were based on the mutual exchange of collectors and researchers from COMECON countries. Since 1991 they have been financed from research projects or other sources. They were always concentrated on a certain crop group. However, additional crops also were collected and given to particular specialized institutions. The specialization was mainly for fodder crops, the genus *Allium* and the tribus *Triticeae*.

To fill the gaps in germplasm collections a project: "Gathering, Collection and Conservation of Wild Genetic Resources and Landraces in Czech Republic" was accepted by the Grant Agency of the Czech Republic in 1993. The aim of this project was to collect and conserve the widest genetic diversity of wild fodder plants, wild relatives of cultivated crops and threatened landraces of fruits and other crops. Seed samples were regenerated and conserved in the Gene Bank at RICP Praha, and vegetatively propagated species in form of a permanent nursery. In addition to salvaging threatened germplasm, the gathered material became available for study and utilization as a source of valuable traits for breeding or for direct cultivation. The project was prepared at the Gene Bank, RICP Praha, with co-operation of the Agricultural University Brno, Research Institutes for Fodder Plants Troubsko, Research Station for Grasses Zubří, and the Research and Breeding Institute for Fruits, Holovousy.

During a 3-year expedition activity, various phyto-geographic regions of Czech Republic with a rich flora were visited. Many of them are protected as National Parks and Protected Landscape Regions. Altogether, over 2,600 samples have been collected (Table 2). Larger samples were partly placed into the base collection of the Gene Bank, smaller samples were regenerated within specialized germplasm collections. Subsequently, all samples went through a base evaluation. They got national accession numbers and all available passport data were entered into the germplasm information system EVIGEZ. The aim was to include all samples into the collections except for nonviable, diseased or other unsuitable samples. With fruit trees it was not possible to use this extensive way because the costs for conservation of perennial species are higher. After consultation with national park headquarters, existing or newly drawn distribution maps were used to estimate the areas of collecting, and an inventory and a determination were made and the results were drawn onto the maps and into the legend. Interesting and healthy trees, rare or missing cultivars were marked in the field and map, grafts were taken or will be taken during repeated visits or by local people or regional park wardens. The grafts were grafted on rootstocks in the nursery, the plants went through a base evaluation and selected types will be included into a permanent collection of RBIF Holovousy.

Project of the Ministry of Agriculture: ”The Mapping, Collecting and Conserving of Threatened Landraces and Wild Plants Related to Cultivated Crops in the Czech Republic and Bordering European Region” is a continuation of former activities. The distribution of this extensive genepool is searched for, mapped and compared with available lists of registered, bred cultivars. The missing materials are searched for and gathered from domestic and foreign sources and by expeditions. Valuable and interesting wild ancestral forms and species related to cultivated crops are also mapped and collected during systematic expeditions. As a result, except for collected samples, inventory, distribution maps and computer documentation will be provided. Further collection priorities will be formulated for regions and species. *Ex situ* or the necessity for *in situ* conservation strategy will be designed and discussed.

The diversity of natural and semi-natural habitats, plant species and intra-specific diversity of wild plants decreases from year to year and expeditions can at least save part of this richness and make them available for use. The collected material can serve to rejuvenate the biodiversity of meadows and pastures damaged by intensive large-scale production. Having a good seed technology for small samples, regional

grass mixtures could be provided for rejuvenation of damaged places at botanically valuable sites, such as grassing of ski pistes or after construction in national parks.

Preserving the widest genetic diversity of crops and their wild relatives especially of domestic origin has to be one of the basic duties of each nation. Gathering them in gene banks or in specialized collections as well as their documentation enable their utilization in breeding, research and documentation. Sustained plant breeding will be impossible without using collections of traditional crops and wild species.

Tab. 1. Overview of collected/mapped plant genetic resources in the Czech Republic covered by projects of 1993-1995 (Grant Agency of the Czech Republic) and 1996-1997 (Ministry of Agriculture).

Collected by:
B - Mendel University of Agriculture and Forestry, Brno; F.Kühn,
H - Research and Breeding Institute for Fruits, Holovousy; F.Paprštein, J.Kloutvor,
R - RICP, Gene Bank, Praha-Ruzyně; V.Holubec, R.Bocková,
O - RICP, GB Olomouc; V.Chytilová,
T - Research Institute for Fodder Plants, Troubsko; I. Zapletalová,
Z - Oseva, Research Station for Grasses, Zubří; M.Ševčíková, P.Šrámek

Region	Institu-tion	Grasses	Legumes	Meadow /medicinal	Fruits	Protected	Other	Total
Karpaty 93	BRTZ	53	60	85	8	3	41	250
Brněnsko 93	T		13					13
Znojemsko 93	T		12					12
Českomor.v. 93	T		10					10
Rokytnice 93	H				10			10
Molitorov 93	H				58			58
Brněnsko 93	H				2			2
Hostýnské v.93	Z	7						7
Beskydy 93	Z	10						10
Šumava 94	BHRTZ	238	142	47	53/200		7	487
Znojemsko 94	T		112	51			6	169
Brněnsko 94	T		41	4				45
Českomor.v 94	T		3	5				8
B.Karpaty 94	Z	3	13	28			10	54
Beskydy 94	Z	24						24
Krkonoše 95	HRTZ	202	56	47	38/200	33		376
Znojemsko 95	T		172	117				289
Brněnsko 95	T		74	27				101
Č.Středohoří 95	Z	149	4					153
Beskydy 95	Z	51						51
Orlické hory 96	HORTZ	131	69	53	8/200	4	4	269
Podyjí 96	T		71	43			1	115
Brněnsko 96	T		66	40			1	107
Podyjí 97	HRTZ	106	64	48	10/120			228
Znojemsko 97	T		40	47			10	97
Brněnsko 97	T		4	2				6
Slavkovský les 97	Z	75				1		76
Beskydy 97	Z	18						18
Total		1073	1010	644	187/720	41	80	3045

Tab. 2. Overview of international expeditions - missions abroad or domestic with foreign participation.

Collected by:
B - Mendel University of Agriculture and Forestry, Brno
O - Research and Breeding Institute for Vegetables, Olomouc, later RICP, GB
R - RICP, Gene Bank, Praha-Ruzyně
T - Research Institute for Fodder Plants, Troubsko
Z - Oseva, Research Station for Grasses, Zubří

Collector	Year	Institute	Collection site	Participation	Aim	Aimed coll.	Coll. total
Šrámek M.	1971	Z	CSK - Beskydy	DDR	Grass	30	30
Šrámek M.	1973	Z	DDR - Erzgebirge		Grass	35	35
Janeček	1975	Z	CSK - Beskydy	POL	Grass	55	450
Holubec	1986	R	Transcaucasia	POL, RUS	*Triticeae*	58	166
Havránek	1986	O	FRA, ESP		*Allium*	23	23
Vaněk	1987	Z	POL	DDR, SVK	Fodder pl.	65	181
Ševčíková, Vacek, Janeček, Šrámek	1987	TZ	CSK: Moravia, Slovakia	DDR, BGR, HUN, POL	Fodder pl.	82	82
Holubec	1988	R	BGR		*Aegilops, Triticeae*	54	73
Havránek, Navrátil	1988	O	Central Asia	USA	*Allium*	123	123
Vaněk	1988	Z	DDR - Spreewald	POL, SVK	Grasses	58	58
Kühn, Hauptvogel, Holubec, Ševčíková, Zapletalová	1990	BRTZ	CSK: Biele, Malé Karpaty	SVK	Landraces	89	89
Holubec	1990	R	MNG	RUS	*Triticeae*	43	150
Janeček	1989	Z	Transcaucasia	BGR	Fodder pl.	111	293
Havránek	1990	O	Altai, Siberia	RUS	*Allium*	76	76
Holubec	1993	R	TUR, GRC		*Triticeae*	70	220
Holubec	1994	R	Central Asia		*Triticeae*	40	70
Holubec, Kühn, Paprštein, Ševčíkova, Zapletalova	1994	BHRTZ	CZE, AUT - Šumava	AUT	Landraces, wild plants	487	487
Holubec, Paprštein, Ševčíkova,Zapletalova	1995	HRTZ	CZE, POL - Krkonoše	POL	Landraces, wild plants	376	376
Dušek, Moravec Chytilová, Losík Křístková	1995	O	SVK: Biele Karpaty		Vegetables	99	99
Dušek, Moravec Chytilová	1995	O	Slovakia: Orava		Vegetables	20	20
Křístková	1995	O	CZK: Ostrava Reg.		Vegetables	69	69
Ševčíková, Šrámek	1996	Z	Beskydy, SE Moravia	JPN	*grasses, Phleum,Lolium*	62	64
Havránek	1996	O	Albania		*Allium*		
Holubec	1996	R	Albania		*Aegilops*	18	21
Holubec, Chytilová Paprštein, Ševčíkova, Zapletalova	1996	HORTZ	CZE, POL- Orlické Mts.	POL	Landraces, wild plants	269	269
Holubec, Paprštein, Ševčíkova, Zapletalova	1997	HRTZ	CZE, AUT - Podyjí -Thayatal, Danube valley	AUT	Landraces, wild plants	228	228

GATHERING, EVALUATION AND UTILIZATION OF PLANT GENETIC RESOURCES COLLECTIONS

Z. STEHNO

In the last two decades increased attention has been paid to the protection of plant genetic resources (GR). Activities in the 1970s were aimed at gathering of endangered PGR and establishing conditions for their maintenance.

In connection with increasing numbers of collections, the documentation systems for PGR have been developed intensively to simplify the manipulation of maintained samples and to improve the clarity of work with the gathered information. Various characterization methods are used to distinguish samples and to identify duplications in PGR collections. The methods of characterization are being constantly improved.

Recently, more and more attention is paid on measures to increase the usage of the PGR collections in crop breeding. Sufficient information on the samples is one of the key conditions for their effective use. Good evaluations of genetic resources under conditions that are similar to those under which new cultivars are bred can offer a breeder detailed information about the possible value of a genetic resource for the breeding program. Therefore, more emphasis is put on the evaluation of plant genetic resources. It is possible to take evaluation results from different climate and soil conditions, but only for characteristics that have a very low interaction with environment.

Gathering and evaluating plant PGR (mainly cereals and potatoes) have a long tradition in the Czech Republic. It was practiced at research and breeding stations and directly assisted the breeding programs. After the Second World War, the evaluation was done at specialized institutes and they became responsible for gathering and evaluating of crop collections. At present a network of institutions cooperating within the framework of the ”National Programme on Conservation and Utilization of Plant Genetic Resources" carries out the activities mentioned above. These institutions have been listed in introductory chapter. Procedures for genetic resources characterization have traditionally been included in the system of GR evaluation, and the results form the first part of descriptive data.

The aim of gathering and increasing plant GR collections is to secure biodiversity as thoroughly as possible and thus build up a wide base for the demands by breeders. Primary attention is paid, during PGR gathering, to original Czech and Czechoslovak materials which include domestically bred cultivars, old local cultivars, landraces and wild relatives growing on the former Czechoslovakian territory.

The sources for increases in the numbers of accessions are new cultivars from domestic breeders, foreign cultivars from areas with similar conditions of climate and soil, samples exchanged with other gene banks and finally samples collected by collecting missions. In some cases, it is necessary to reintroduce some original genetic resources from gene banks abroad. This was the situation for sugar beets in the Czech Republic.

The aim of characterizing and evaluating plant GR is to obtain information necessary for their identification and for a more effective use in breeding to improve crop quality and productivity. In considering the extent of collections, two criteria seem to be important for the evaluation process:

1. Selection of characters and properties for evaluation
2. Selection of the genetic resources to be evaluated

Ad 1) Genetic resource characterization, which is included in the system of evaluation, is aimed at morphological characters, and is used for taxonomic classification and for accession identification within a taxonomic unit. Methods of PGR identification by electrophoretic protein spectra or/and suitable molecular techniques are being developed and included into the system. The evaluation consists of data on growth and development, characteristics of the stand, analysis of yield elements, responses to biotic and abiotic stresses, and qualitative characteristics of the product.

Twenty national descriptor lists, for important crops, have been worked out for characterization and evaluation purposes. Descriptor lists are divided into passport and descriptive parts. Characteristics of experimental conditions and scales describing evaluated traits have been included in the descriptive part. Scales used to have nine points and can be adapted for up to 110 characteristics per crop. These detailed descriptor lists have been prepared on the basis of IBPGR/IPGRI, UPOV and former COMECON descriptor

lists. The range of scales for character expressions has been adjusted to climatic conditions of the CR. In comparison with IBPGR descriptor lists, they contain more descriptors for characters and properties of economical importance. In comparison with those of UPOV, they use wider scales to cover a greater diversity within a genus.

Characteristics differ in their importance in breeding. This is taken in account when selecting characteristics for evaluation. Resistance to diseases and quality indicators are frequently included in this group of characteristics.

Ad 2) It is necessary to resolve the question how to select GR for evaluation if all parts of a collection had not been evaluated annually from the beginning. One solution may be so called "core collections". Such a collection is the smallest set of genetic resources that covers a wide range of crop diversity. Detailed evaluation is done on that set first.

The system of plant GR evaluation in the CR comes from principles defined in the "Framework methods for study of genetic resources of cultivated plants in the CR". Evaluation of vegetatively propagated crops takes place during their maintenance in field collections. The evaluation of seed propagated crops is divided into three stages:

1. The first year of evaluation serves first for multiplication of imported or exchanged small seed samples and for their preliminary evaluation. Small amounts of seed is sown in a few rows and after a preliminary evaluation the samples found to be unsuitable for inclusion in the collection (appearance of quarantine diseases etc.) are excluded from the set.

2. Experiments on plots planted in the second phase are used as a source of evaluation data. Each plot is divided into a part for harvest, a part for taking of samples and protective part. The harvest part is used for a rough measurement of yield. The samples taken from the second part are analyzed to describe yield components, quality characters and harvest index. The experiments are sown in one replication, after considering the large number of accessions and the limited amount of seed. Each accession is evaluated at least for 2 years. During the vegetation period, plant morphology, growth and development data are registered, and reaction to the most important diseases and winterhardiness of winter forms are tested. Characteristics of quality of the end product (content and properties of important substances) are tested. The samples included in this evaluation phase become part of the crop collection and they receive a national accession number (ECN), mostly in the first year of evaluation. The results allow choice of promising genetic resources for evaluation in more detail in the third phase of the system.

3. In some cases, the experiments of this evaluation phase are prepared in co-operation with a breeding company, often the future user of the PGR. Only a small part of the GR from the previous evaluation step is included in the experiments. These are arranged as replicated trials in more representative plots (e.g. plot size 10 m^2). The evaluation proceeds like in the previous phase for two or more years. However, through evaluation in more replications (in more environments), a more reliable assessment can be achieved in characteristics having higher interaction with environment (yield and its components, quality characteristics etc.).

The results obtained in the last two phases are compared to the mean of two to three local check cultivars. Check cultivars are kept the same for a long time to enable a comparison of GR evaluated in different years and from different sets. If a change of check cultivars has to be done, it is made step by step and the exchange of one cultivar is overlapped by another one (s).

Results of PGR evaluation are expressed in point-scales (in some characteristics this is the only form for describing their expression) or as original metric data. Original data are transformed into point-scales according to the above mentioned descriptor lists for descriptive database purposes.

Original data are passed along to breeders as a source of information for selection of suitable GR. They are also elaborated for professional and scientific publications. It is recommended to collection holders to maintain measured data in the original form in their own database as well.

Results transformed into point-scales form become part of the descriptive GR database. A sufficiently extensive descriptive database will be used to select GR required by breeders. However, the present status of a descriptive database is low and insufficient for the above purpose. More attention is paid to this task in the "National Programme on Conservation and Utilization of Plant Genetic Resources".

For breeding use, information that can be considered as supplementary or compensatory (in the case of PGR that were not evaluated) is also important. For instance, the genealogy of a cultivar is useful for the breeder if he knows the parents and can predict the suitability of a PGR for a special breeding program. The eco-geographic origin of a PGR can likewise be considered during pre-selection of parental components (e.g. resistance to high salt concentration in soil is supposed to occur in PGR collected in areas having such soils).

Moreover, information on genes identified in PGR can to be considered as the most important and even more valuable than the evaluation of some characteristics. Lists of them have been published and regularly updated. For instance, the gene bank at RCIP, Praha, published a catalogue of 46,000 wheat PGR in cooperation with the Russian Academy of Sciences in 1992 and further. PGR with a known pedigree and/or identified genes of key characteristics or features have been included in the catalogue.

Results of evaluations published or transmitted to users in other forms are the base for requests of PGR samples by breeders and other users like research or other institutions.

Changes in the structure of Czech agriculture influenced the spectrum of requested PGR. Increased attention is being paid to old landraces and related wild species, although balanced high productive genotypes remain the main point of interest for breeders.

In accordance with international conventions, the exchanges of samples of genetic resources are provided by the gene bank free of charge. However, breeders' rights protection is guaranteed in the framework of the UPOV convention.

In a number of cases, genetic resources supplied to breeders have been used in the development of new cultivars or breeding materials. Acknowledged co-authorship of cultivars indicate successful PGR use.

The collection holder is responsible for maintenance of the PGR in a living state and for their evaluation. In the case of vegetatively propagated crops, PGR can be maintained in the form of field collections (fruit-tree or hop gardens, vineyards etc.), as a tissue culture or by the use of cryo-technics.

Samples of generatively propagated GR are prepared by the collection holder in the needed quantity and quality and transferred into gene bank storage. Seeds are taken from plots without admixtures, harvested carefully in a suitable stage of ripeness. The collection holder is responsible for seed purity, its healthy state, viability, and for exact sample documentation. The volume of a seed sample is determined by the number of seeds and differs depending on whether the crop is self-pollinated or cross-pollinated. It is recommended that a sample of a self-pollinated crop should consist of at least 7,000 seeds. To cover intra-population variability of cross-pollinated crops, it is recommended to store a sample with 12,000 seeds.

The collection holder is also responsible for seed multiplication if the viability of seed samples stored in the gene bank has decreased to the limit of germination or the seed stock nears depletion.

During the seed multiplication of cross-pollinated crops the plots have to be isolated by space or technical means. During multiplication, sample originality is controlled e.g. by comparison with original plant (or parts of plant) samples maintained. Negative selection of possible admixtures takes places in the plots. Harvest has to be done very carefully and must follow the regulations described above.

GENE BANK RICP, PRAHA

EVALUATION AND UTILIZATION OF GENETIC RESOURCES COLLECTIONS OF WHEAT, TRITICALE, WINTER BARLEY, WILD *TRITICEAE*, BUCKWHEAT, MILLET AND *AMARANTHUS*

1. GENETIC RESOURCES OF WHEAT, TRITICALE AND WINTER BARLEY

Z. STEHNO, M. VLASÁK

Importance of some small-grain cereals - wheat, triticale, winter barley.

In the Czech Republic, like elsewhere in the world, wheat is one of the most important sources of human nutrition. It is grown in all favorable regions of the world and occupies nearly 250 million ha. In the Czech Republic, wheat was grown in 1997 on 825,450 ha, i.e. 48.9 % of area grown to cereals. A slight decrease of the wheat area in the Czech Republic coincides with the equalization of supply and demand of this commodity for both inner and outer markets.

Wheat can be grown in various climates. This is possible because of the existence of winter and spring wheat types. Winter wheat cultivation in temperate zones is supplemented with spring wheat. Spring forms used to be grown in warmer zones of the temperate belt and subtropical regions, where there is no appropriate vernalization temperature for winter wheat. It can also be grown in regions with severe winters where winter wheat would be killed by frost.

This wide zone for wheat growing and the nutritional significance of this crop prompts breeders to create new, more efficient cultivars. For breeders, the proper selection of parental material as donors of properties and characters is most relevant.

Triticale - the first crop artificially created by man - was bred with the aim to combine the advantages of wheat and rye. Significant achievements in breeding of winter forms of triticale have been reached in Poland. After the problems with grain shriveling had been solved, triticale is grown as an important fodder crop. In the Czech Republic, triticale was grown on 14,912 ha in 1997. Breeding is aimed also at spring forms of triticale, and has been worked on intensively e.g. at the International Center for Maize and Wheat Breeding, CIMMYT, in Mexico.

Winter barley breeding was concentrated under COMECON in the former East Germany. Only in the 1970s breeding of this important fodder crop was restored in the CR. In connection with barley improvement, much attention has been paid to genetic resources of winter barley. Growing areas of barley increased in the 1980s and recently stabilized around 160,000 ha. In addition to traditional six-row forms, breeding was also devoted to two-row forms, also for possible use in malt production.

More and more are plant genetic resources with a wide range of traits and information on them becoming important conditions for the selection of appropriate parental components in the breeding process.

History and the Present

The gathering and practical use of wheat GR has a long tradition in the Czech Republic, going back to the start of this century. After World War II, partial collections were transferred to two important places: Research Institute of Crop Production, Praha - Ruzyně (RICP) and Research Institute of Cereals, Kroměříž (RIC). The gathering and evaluation of wheat collections at two places is due to the importance of this crop, but also to the differences in climatic conditions in different regions of the country. The wheat collection is subdivided by growth habit into sub-collections of winter and spring wheat.

In the former Czechoslovakia, the winter triticale collection was located at RICP Piešťany (Slovakia). After formation of the Czech Republic, the genetic resource collection of this crop was formed at RICP Praha - Ruzyně, and has since then been complemented and evaluated. Because spring triticale has been grown in recent years, a special sub-collection of it was established at RICP in 1992.

Considering that spring and winter types of barley have different production uses, no matter what the climatic conditions are, the responsibility for sub-collections has been divided between RIC Kroměříž (now ARI Kroměříž, Ltd.) and RICP Praha - Ruzyně. The winter barley collection has been gathered since 1951.

Last year's additions to and the current status of the small-grain cereals collections mentioned above are given in Tab. 1. The data show that the wheat sub-collections are the largest, and also that the sub-collections of species of wheat are the most diverse, as shown in Tab. 2.

Tab. 1. Additions and total numbers of accessions in cereal genetic resources

GR collection	Number of accessions	
	Additions in 1997	Total
Winter wheat	448	5778
Spring wheat	74	3929
Winter barley	24	1717
Winter triticale	5	344
Spring triticale	15	120

Tab. 2. Species proportions in the winter and spring wheat sub-collections

Species	winter	spring	Species	winter	spring
T. monococcum	10	18	*T. araraticum*	3	
T. boeoticum	10	1	*T. militinae*		1
T. sinskajae		1	*T. timopheevii*	1	4
T. dicoccoides		7	*T. spelta*	28	15
T. dicoccon	6	86	*T. macha*	2	2
T. karamyschevii	2		*T. compactum*	17	27
T. turgidum	24	27	*T. aestivum*	4838	3008
T. carthlicum		13	*T. vavilovii*	2	
T. ispahanicum		1	*T. sphaerococcum*		11
T. polonicum		16	*T. petropavlovskyi*		1
T. durum	101	723	*T. fungicidum*		4
T. aethiopicum		2	*T. timonovum*	1	
T. turanicum	2	2	*T. timococcum*	1	

The four most widespread botanical varieties are listed in Tab. 3. Bread wheat (*Triticum aestivum* L.) is the most important wheat species in our growing conditions.

Tab. 3. Proportions of the most frequent botanical varieties of *Triticum aestivum* L.

Variety	winter %	spring %
lutescens	55,8	27,7
aestivum	23,3	31,8
milturum	5,9	4,2
ferrugineum	4,4	11,3
other	10,6	25,0

In the barley collection and also in Czech agriculture, *Hordeum vulgare* L. is the most frequent species.

Triticale is not taxonomically subdivided in detail; only the ploidy level was determined.

Resources for Extending the Present Collections.

Since the GR collections mentioned above are still intended for use in breeding before long, attention is focused on obtaining newly released cultivars from abroad and from domestic breeders. On the base of information from lists of released cultivars, commercial catalogues and professional articles, seed samples are requested from breeding companies.

In accordance with a FAO resolution from 1983, the Czech gene bank is carrying out a free exchange of cereals and other crop genetic resources with similar institutions abroad (gene banks, research or breeding centers, etc.).

However, original domestic materials including old cultivars and landraces are evaluated as the most important parts of the collections.

Characterization and System of Genetic Resources Evaluation

Characterization that serves for GR identification is part of the GR evaluation system in the Czech Republic. Methods of characterization are the taxonomic determination of a GR, its morphological characters, electrophoretic identification and molecular techniques. As material for morphological identification, samples of spikes are taken in each year of the evaluation. The spikes are kept to assure the identity of the samples during regeneration.

The primary objective of plant genetic resources evaluation is to enable the breeder to make better use of genetic resources to increase the productivity of crops. However, evaluation results that were obtained under different climatic conditions can be applied only in characteristics with low interaction with the environment. Therefore, the evaluation has been carried out systematically, so that there were no problems with a backlog of non-evaluated samples. It is now necessary to computerize the data to make them more readily available for practical use.

The system of evaluation is contained in the "Framework Methods for Study of Crop Genetic Resources in the Czech Republic".

In the first year, seed of the accessions is increased to be available for further evaluation.

In the second stage of evaluation small plot experiments are performed; they are used to obtain description data. Plant morphology, growth and development stages are observed during the vegetation; reactions to the most frequent diseases (rusts, powdery mildew, septoria etc.) are tested, and winter cereals are evaluated also for winterhardiness. Samples to estimate harvest indexes and for detailed ear analyses are taken before harvest. In grain samples, the contents of valuable substances are measured. In bread wheat, attributes for baking quality (protein content, level and properties of gluten, gluten index, SDS sedimentation) are evaluated. Potentially promising GR are selected for a more detailed analysis in the third stage of the evaluation.

In the third phase, about one-tenth of the items in a collection are evaluated in field trials in four replications. This evaluation lasts for two years. The spectrum of characteristics is similar to that of the previous evaluation stage. These experiments give a more exact estimation of the yield capacity of the tested accessions.

The results obtained in the last two stages are compared with data from two to three standard cultivars of local origin. In the case of spring triticale, a spring wheat cultivar is used as a standard because no spring triticale cultivars have been released up to now in this country. Manifestation of characteristics and properties is expressed in 9 to 1 scales, according to descriptor lists for the genera *Triticum*, *Hordeum* and *Triticale*. These lists include 31 passport descriptors, 5 descriptors to characterize the experimental conditions, and up to 110 descriptive characteristics and properties.

Utilization of GR in Breeding

In addition to filling a database with data coded in scales, original data are summarized as information for breeders. Breeders are provided with results of the evaluations, and on this basis they can

choose and request accessions that appear suitable for their breeding purposes (breeding programs). For example, within the last 3 years breeding and research institutions in CR have been supplied with 998 samples of winter wheat, 419 spring wheat and 121 samples of winter barley. Similarly, 378 samples of these crops have been sent abroad. More details are provided in Tab. 4.

Tab.4. Number of accessions sent to users in breeding and research institutions

Crop	1995		1996		1997	
	CR.	abroad	CR	abroad	CR	abroad
Winter wheat	391	182	255	211	188	336
Spring wheat	224	7	164	56	144	30
Winter barley	31	20	58	0	50	8

Breeders utilize the obtained materials to develop breeding lines, and some of the GR are part of the pedigree of new cultivars. Evidence for the use of certain genetic resources and their importance is a declaration of co-authorship for new cultivars to GR specialists. This can be considered as a particularly clear evidence of effective usage of a GR. Thus, members of our research team became co-authors of the winter wheat cultivars 'Sofia', 'Asta', 'Zdar', 'Samanta' and 'Siria'; of the spring wheat 'Jara' and 'Maja', and the winter barley 'Lunet' and 'Okal'.

2. WILD *TRITICEAE* COLLECTION AS GENETIC RESOURCES FOR BREEDING

V. HOLUBEC

Annual as perennial *Triticeae* grasses, particularly those species that are not cultivated, are subject to sustained selection for resistance to insect pests and diseases, and therefore may possess useful characters of resistance. In contrast, such characters may have been lost in wheat through thousands of years of selection for productivity (Russell, 1978). The spectrum of harmful pests and diseases and their races changes in time and from place to place and it offers a good chance to search for useful genes. Up to now, many researchers and breeders have introduced genes for resistance or tolerance to diseases, pests and abiotic stresses.

The Czech wild *Triticeae* germplasm collection of the Gene Bank Praha-Ruzyně includes over 1,300 accessions of annual and perennial species. Over 75 % of them belong to the subtribe *Triticinae* Trin., 21,5 % to the *Hordeinae* Dumort. and only 3 % belong to the monotypic subtribe *Agropyrineae* Nevski. There are 133 species in the *Triticeae* collection belonging to 19 genera possessing roughly 20 independent haplomes. They form monogenomic genera or by combining of the haplomes they form polyploid species/genera.

The material comes from several collecting missions to Russia, Transcaucasia, Mongolia or Central Asia or it was received from various sources (IPK Gatersleben, Germany, Utah State University, Logan, USA and others).

Within the annuals *Aegilops* and wild wheats (*Triticum*) are highly prevailing and they were extensively evaluated and used in breeding. Other, rather neglected annuals and perennial species are still waiting for their utilization, because they represent an enormous source of resistances as a secondary genepool for cereal improvement or as a primary genepool for fodder crops breeding.

Resistance to the most virulent races for the Czech conditions of stem rust *Puccinia graminis* f.sp. *tritici* Erikss. et Henn, brown rust *P. recondita* Rob. ex Desn., stripe rust *P. striiformis* Westend and powdery mildew *Erysiphe graminis* f.sp. *tritici* (DC.) Marchall was tested on adult plants in the infection field or on seedlings in the greenhouse. Infestation of cereal aphids *Sitobion avenae* (F.), *Metopolophium dirhodum* (Walk.), *Rhopalosiphum padi* (L.) and *Sipha elegans* del Guer. was observed during several years. Relatively lower aphid occurrence in 1990 1991, 1995 and 1996 show distinctly an aphid preference for individual *Triticeae* species.

Species of the genus *Aegilops* vary considerably in response to rust and powdery mildew infection. Within the tested accessions only *Ae. speltoides* was completely resistant to stem, leaf and stripe rusts and powdery mildew. It is considered the most resistant species within the genus *Aegilops* in agreement with our previous results (Holubec et al., 1992) and other authors (Pasquini, 1980, Valkoun, 1985).

Non-Aegilops accessions with a low or no reaction to leaf diseases and cereal aphids belong to the following species: *Elymus caninus, E. dahuricus, Lophopyrum elongatum, Leymus racemosus, Psathyrostachys juncea, Thinopyrum junceum,* and *Dasypyrum villosum*. There is a high level of combined resistance within *Agropyron cristatum* group. Some accessions of the following species showed also a high level of combined resistance: *Hordeum brevisubulatum, H. secalinum, Elymus fedtschenkoi, E. mutabilis, E. yezoensis, Leymus angustus,* and *L. villosissimus* (Holubec et al. 1998)

In case of disease resistance, the genera *Dasypyrum* and *Thinopyrum* were the most resistant to leaf diseases, *Psathyrostachys* was infected only by leaf rust, but in the later developmental stage. *Hordelymus* was infected only by powdery mildew, *Taeniatherum* only by stem rust. Generally, stem and leaf rusts had much higher share of infection than stripe rust and powdery mildew.

In case of aphid infestation, it is possible to conclude SA was a highly prevailing aphid in all years and *Triticeae* genera over the other aphids. The genera *Heteranthelium, Taeniatherum, Thinopyrum* and *Lophopyrum* were avoided by aphids at all, *Dasypyrum* was heavily infested only by SA.

Sipha elegans and *S. glyceriae* were reported to be present on *Triticeae* grasses since 1995 as now and potential pathogens for cereals in Czech Republic. *Sipha elegans* heavily infested one accession of *Elymus sibiricus*, further *Elymus dahuricus* and four accessions of *Hordeum brevisubulatum* collected from Mongolia. *Sipha glyceriae* was found only on *Hordeum bulbosus* and *Elymus schrenkianus.*

Table 1. The *Triticeae* collection of Gene Bank Praha-Ruzyně

Genus	Haploid genome	No. acces. in collect.	No. spp. in collect.	Ploidy levels
subtribus *Agropyrinae* Nevski				
Agropyron J.Gaertn.	P	42	5	2,4,6
subtribus *Hordeinae* Dumort.				
Crithopsis Jaub. et Spach	K	5	1	2
Elymus L.	HS	84	40	2,4,6,8
Elytrigia Desv.	EJS	14	5	6,8,10,12
Heteranthelium Hochst.	Q	2	1	2
Hordelymus (Jessen)Harz	HT	2	1	4
Hordeum L.	H	78	17	2,4,6
Leymus Hochst.	JN	44	15	4,6,8,12
Lophopyrum A.Löve	E	8	3	2,4,6
Pascopyrum A.Löve	HJNS	2	1	8
Psathyrostachys Nevski	N	19	2	2
Pseudoroegneria (Nevski) A.Löve	S	10	4	2,4
Taeniatherum Nevski	T	14	2	2
Thinopyrum A.Löve	J	8	2	2,4,8,10
total subtribus		290	94	
subtribus *Triticinae* Trin.				
Aegilops L.	C,D,M,N,S,T,U	880	21	2,4,6
Triticum L.	A,AB	80	5	2,4,6,8
Secale L.	R	19	3	2
Dasypyrum (Coss.et Dur.) T.Duran	V	21	1	2,4
Eremopyrum (Ledeb.) Jaub.et Spach	F	12	4	2,4
total subtribus		1012	34	
total *Triticeae*		1344	133	

Wild cereal ancestors *Hordeum* and *Secale* were more infested by all aphids than other perennial species. The direct wheat ancestors, wild *Triticum* and *Aegilops* were infested twice as high as *Hordeum* and *Secale*. The number of completely resistant accessions as to leaf diseases as to aphids differ on the subtribe level: one third (31-36 %) of accessions is completely resistant to either one group of pathogens in the *Hordeinae* subtribe, only 6 % or none of them respectively possess the tribe *Triticeae*. The *Hordeinae* subtribe is much wider source of resistances to the studied pathogens.

Within the perennial species of the tribe *Triticeae* a great diversity in resistance to leaf diseases and cereal aphids was found. The species possessing homologic and homoeologic genomes to wheat - *Aegilops* subg. *Sitopsis* and section *Vertebrata* are heavily infested by aphids (Holubec and Havlíčková, 1994). *Aegilops tauschii* with homologic D genome of wheat is very susceptible to rusts and powdery mildew (Holubec et al., 1994). A combined resistance to various pathogens is hardly to find in wheat ancestors, *Aegilops* and *Triticum*. In perennial species, there is much higher percentage of completely resistant accessions.

3. COLLECTIONS OF SELECTED UNDERUTILIZED CROPS IN RICP PRAHA

A. MICHALOVÁ

The problems of genetic resources of other alternative crops are solved in the Institute of Crop Production in Praha - Ruzyně since the year 1993. In this way, relatively large collections of buckwheat, millet and amaranth were newly formed. Within the realization of the "National Programme" the further complement evaluation and selection of the most perspective genotypes for growing under conditions of the Czech Republic is taking place.

Collections of selected alternative crops and the numbers of gathered accessions

Crop species	No. of accession
Common buckwheat *(Fagopyrum esculentum)*	119
Tartary buckwheat *(Fagopyrum tataricum)*	16
Amaranth *(Amaranthus* sp.*)*	128
Quinoa (*Chenopodium quinoa)*	35
Common millet *(Panicum miliaceum)*	163
Other millet species *(Panicum* sp.*)*	6
Foxtail millet *(Setaria italica)*	21
Barnyard millet *(Echinochloa frumentacea)*	1
Crabgrass (*Digitaria sanquinalis)*	1

Collection of common buckwheat and tartary buckwheat involves 135 accessions the major part of which was obtained from foreign gene banks. The major part of buckwheat genotypes originates from the countries of former Soviet Union (38), Bhutan (24) and Japan (10). The indigenous material is represented by 11 accessions; lower number comes from Poland (5), Germany (4) and of other countries. The numerous group is formed by the accessions of unknown origin (26). In the history the buckwheat had an important position on the territory of Czech and Slovak Republics and in certain regions buckwheat growing was very popular. Later the irreversible loss of local varieties took place and therefore only small part of the collection is indigenous material. Now the interest in buckwheat has increased due to its excellent properties and nutritional value based on the favorable composition of protein complex, fibrous material, mineral compounds and vitamins including B_2 (riboflavin) and P (rutin flavonoid).

The millet collection is within the group of alternative crops the largest one. Like that of buckwheat the most of genetic resources originate from former Soviet Union (51), of unknown origin are 21 accessions. Relatively high numbers of accessions are Hungarian, Afghan and Turkish genotypes (18, 17 and 13 respectively) rarely are presented other countries (India 6, China 6, Japan 5). The proportion of indigenous materials is even lower than in buckwheat collection. The whole collection contains (including two released cultivars ´Hanácká Mana´ and ´Unicum´) only 4 indigenous accessions. Important local cultivar ´Slovenské červené´ was repatriated from US gene bank. The object of study became also foxtail millet (*Setaria italica*), barnyard millet (*Echinochloa frumentaceae)*, and the hairy crabgrass (*Digitaria sanguinalis*).

The Amaranth (*Amaranthus* sp.) belongs to very old cultural plants grown 5 - 8000 years ago. The green parts and especially the seeds were components of daily food of ancient Aztecs and other Indians. The genus *Amaranthus* involves more than 60 species, known mostly as weedy plants but also used as leaf vegetables. For seed production especially *A.cruentus*, *A.hypochondriacus* and *A.caudatus* are grown. The collection of 95 genotypes is represented by 8 species of the genus *Amaranthus*. From the taxonomic point of view 26 accessions are not yet classified and 5 genotypes are inter-specific hybrids.

Quinoa (*Chenopodium quinoa*) is similarly as amaranth perspective for special diets. The collection is in the state of formation. There are gathered more than 30 accessions. The major part of these materials will be involved in field tests.

Alternative and neglected crops are generally characterized by broad diversity and low level of genetic improvements through breeding. Therefore, collections often provide possibilities for selection of most suitable genotypes for practical growing or further breeding.

GENE BANK RICP, PRAHA - WORKPLACE OLOMOUC

COLLECTIONS OF VEGETABLES, AROMATIC AND MEDICINAL PLANTS

K. DUŠEK, E. KŘÍSTKOVÁ

Characteristics of the Gene Bank at Olomouc

The Gene Bank at Olomouc is part and a workplace of the gene bank at RICP, Praha-Ruzyně. It is responsible for saving and exploring the genetic diversity of the traditional Czech species of vegetables, medicinal, aromatic, spice and herb plants.

As a member of an international network of gene banks it holds the international collection of the vegetatively maintained accessions of the genus *Allium*, especially of garlic and onion, and the international duplicate collections.

In the Czech Republic, the Gene Bank in Olomouc is the only government-sponsored workplace responsible for keeping those genetic resources. It provides samples free of charge to all applicants, especially to research institutes and breeders worldwide. It also focuses on under-utilized species.

History

The foundations of genetic resource collections of cultivated plants in our country originated at the end of the last century. The first collection of genetic resources of Czechoslovak vegetable species was kept from about 1920 at the Moravian Institute of Agricultural Research at Brno. When the activity of this institute was stopped in 1951, the collections were placed in the newly established Research and Breeding Institute of Vegetables at Olomouc. During the 50-year existence of this institute, a wide assortment of vegetable cultivars was kept simultaneously with vegetable breeding. A substantial part of these collections originated from breeding collections of Vladimír Beneš, Vladimír Šmerda, Jaroslav Homola, Oldřich Konvička (founder of this institute and cytogeneticist), of physician, biochemist and pharmacist Jan Kabelík, and from the world-renowned geneticist František Frimmel. From 1961 on, the collections of genetic resources at Olomouc were augmented by accessions from other research institutions followed by their curators Miloš Chládek and Josef Grabovský.

The collection of garlic was completed by accessions from František Mareček who was from the Research Institute of Crop Production in Praha. Jiří Moravec headed the Gene Bank for 30 years, later with Stanislav Kvasnička.

In the 1950s the isolation cages, supplied with an irrigation system, were constructed for the regeneration of cross-pollinated species. There, Jan Lužný initiated the pollination experiments with bumblebees and flies. Initially, seeds were stored in paper bags at a temperature of 20^{o}-25^{o} C. Later, they were stored in hermetically closed bags and at low temperature.

The index-card system to keep records of accessions was later computerized. During regeneration, the accessions were evaluated for multiple characters. For this purpose, many descriptor lists were elaborated. Also, new accessions were obtained from similar institutions abroad, and during expeditions in the former Czechoslovakia and some neighboring states, in Central Asia, Siberia, Mongolia and Cuba. A collection of seed catalogues from the former Czechoslovakia, Czech and foreign institutions and companies has been compiled there for 50 years. It has a major historical and professional value.

Genetic resources provided the initial material for breeding. About 50 new cultivars and hybrids were bred directly at the Research and Breeding Institute of Vegetables at Olomouc; many others at different breeding stations.

Current status and activities of the Gene Bank

Since 1994 the Gene Bank belongs to the Research Institute of Crop Production (RICP) in Praha-Ruzyně. It continues the traditional genetic resources work and is focused on collecting and keeping original Czech cultivars, old landraces and their wild relative species from the territory of the Czech Republic. The international collection of the vegetatively propagated accessions of the genus *Allium* and safe duplicate international collections represent an important part of its activities.

The fundamental activities include:

- collecting, regeneration and short-term storage of accessions
- distribution of regenerated accessions to freezing boxes at the Gene Bank of RICP in Praha for long-term storage
- description (including photo-documentation) of morphological and agricultural characters of individual accessions
- completion of passport and evaluation data using the national information system EVIGEZ
- distribution of samples free of charge to breeding and research institutions
- expert and advisory service
- exchange of information and samples with similar institutions in the Czech Republic and from abroad.

In the work with genetic resources, the international standards elaborated by IPGRI are followed.

Within this basic framework, the Gene Bank at Olomouc takes part in other activities:

- participation in research programs
- direct cooperation with breeding stations and research institutions in the Czech Republic and abroad (e.g. Slovakia, Great Britain, Germany, Holland, France, Poland, the USA, Israel)
- membership in special international networks
- participation in the education of students – especially at the Palacký University at Olomouc; Mendel University for Agriculture and Forestry in Brno; South Bohemian Agricultural University at České Budějovice
- publication of scientific articles, participation in scientific conferences in the Czech Republic and abroad, and involvement in their organization.

Equipment of the workplace

The wide-range of species kept necessitates a large scope of professional knowledge and responsibility during their regeneration. Some species need special technical equipment, like isolation cages for the cross-pollinated species (e.g. *Brassica, Cucurbitaceae*), storage space for biennial plants (*Daucus, Beta, Brassica, Allium)* or winter protection of perennials (e.g. medicinal and aromatic plants and vegetatively maintained wild species of *Allium*).

The diversity of species and different needs of plants for cultivation and protection preclude the broad use of field mechanization. Each plant species needs an individual approach. Similarly, the pollination of insect-pollinated species in isolation cages must be done partly by hand. About 1 500 - 1 800 accessions are regenerated every year. The staff consists of 15 persons.

Present state of the collections of genetic resources

In 1994 and 1995, after thorough revisions of all collections, their current state was recognized. The collections were increased by numerous accessions from gene banks abroad and by newly bred Czech varieties. New accessions were also acquired during expeditions in the Czech Republic and Slovakia.

At the end of 1995 the collections consisted of nearly 10 000 accessions, representing about 430 botanical species. They include all common vegetable species cultivated in the Czech Republic and their wild relative species, e.g. *Allium* (1 030 acc.); *Beta* (165 acc.); *Brassica* (332 acc.); *Capsicum* (420 acc.); *Cucumis* (610 acc.); *Cucurbita* (561 acc.); *Daucus* (512 acc.); *Lactuca* (893 acc.); *Lycopersicon* (1 607 acc.); *Phaseolus* (1 048 acc.); *Pisum* (1185 acc.).

In individual collections, differential sets for important plant diseases were established - e.g. lettuce downy mildew *(Bremia lactucae*), cucumber downy mildew (*Pseudoperonospora cubensis)* and cucumber powdery mildew (*Erysiphe cichoracearum, Sphaerotheca fuliginea)*. Among the collections of medicinal, aromatic and herb and spice plants with 969 acc., there is a unique collection of genotypes of caraway (*Carum carvi).*

Perspectives of work with genetic resources

The Gene Bank at Olomouc has good conditions for saving plant genetic resources. Besides its tradition, technical equipment and an experienced staff, the links with universities, research institutes and breeding stations are of fundamental importance. Cooperation with these institutions results in new information about accessions that can often increase their value. Simultaneously, the exploration of genetic resources gives them a deeper meaning.

RICP PRAHA, RESEARCH STATION FOR VITICULTURE, KARLŠTEJN

GENETIC RESOURCES OF THE GENUS *VITIS* IN THE CZECH REPUBLIC

M. HUBÁČKOVÁ

Maintenance of grapevine collections, especially of *Vitis vinifera,* has a long tradition in the Czech Republic. The maintenance and testing of grapevine cultivars began more than 100 years ago. Collections were maintained at state experimental vineyards, viticultural schools and at stations for grapevine breeding. In the last decades most cultivars were concentrated in the collection of the Research Institute for Viticulture and Enology in Bratislava. This collection was prepared in view of the requirements of breeders from all of Czechoslovakia. Since collections of most cultivars were concentrated in Slovakia, the Czech Republic had to establish its own collection based on new international and national regulations. The Research Station of Viticulture in Karlštejn, which was the only station that cooperated with the gene bank in the past, was commissioned to establish this collection in the Czech Republic. The aim of its work was in part to prevent the loss of old and valuable cultivars that are cultivated on lots where the owners will change, especially in stations for grapevine breeding.

In a short time we did a basic reconnaissance and found more than 500 *V. vinifera* cultivars, about 16 stock cultivars for grapevine and more than 100 inter-specific cultivars and hybrids in the Czech Republic.

We concentrated all grapevine genetic resources at three locations in the Czech Republic:

1. Research Station for Viticulture, Karlštejn - genetic resources of *Vitis vinifera;*

2. Faculty of Horticulture of the Mendel Agriculture and Forest University, Lednice Na Moravě – inter-specific hybrids, *Vitis vinifera* genetic resources, wild forms and cultivars for grapevine stocks;

3. Station for Grapevine Breeding, Znojmo - genetic resources of *Vitis vinifera*, stock cultivars and wild forms.

Tab.1 The number of grapevine genetic resources in the collections:

Collection	*Vitis vinifera* cultivars	Inter-specific cultivars and hybrids	Stock cultivars	Wild forms	Cultivars prepared for planting, or for grafting
RSV Karlštejn	246	-	-	-	27
MUAF Brno, FH Lednice	14	113	5	-	-
BS Znojmo	270	-	11	6	-
Total	530	113	16	6	27

* Hybrids from abroad will be transferred to a preliminary collection

Recently, we worked out the passport data of all genetic resources in collections according to the rules of the information system EVIGEZ. We began with the basic evaluation following the national list of descriptors for grapevine. In each cultivar we are evaluating 62 morphological traits and 48 data about the growth phase, resistance to biotic and abiotic stresses and productivity.

Old and interesting *Vitis vinifera* cultivars such as Tramin blanc, Riesling red, Riesling aromatic, Sauvignon red, Kamenoružák bílý, Fraštak, Pinot blue precious, Sylvaner precocious, Portugais blanc, Portugais gris, Červenošpičák, Madlen precious, Madlen royal, Hedvábné zelené, Hedvábné žluté, Muskat precious and many others we concentrated in collections of *Vitis vinifera* in Karlštejn and Znojmo. In the Horticultural Faculty at Lednice na Moravě there are inter-specific forms used in breeding for higher resistance to frost and fungal diseases.

The Research Station for Viticulture in Karlštejn is participating in the international collaborative project "Distinction and Identification of Grapevines" that is coordinated by the Institute for Grapevine Breeding at Geilweilerhof (Germany). The aim of this project is to develop a minimal descriptor list for grapevine varieties to prove the possibility to distinguish and identify grapevine cultivars and to establish a list containing only relevant descriptors. Also, only the international contacts by the Horticultural Faculty at Lednice na Moravě facilitated to assemble a great collection of inter-specific cultivars within a short time.

At present the most important task of all three collections is to reproduce and plant old cultivars from the former Czechoslovak collection in Bratislava. Further tasks are to collect, reproduce and plant old cultivars that are grown e.g. in the backyards of houses, and to regenerate genetic resources from Karlštejn and other old collections (Znojmo for instance holds 90 such cultivars). Besides that, we must continue with the basic and special evaluation of genetic resources. Although the collections are just being established, we are prepared to give a relatively large number of genetic resources for breeding to breeders, but in particular we will preserve this treasure for the next generations.

AGRICULTURAL RESEARCH INSTITUTE KROMĚŘÍŽ, LTD.

COLLECTIONS OF CEREALS

Z. KRYŠTOF, J. MILOTOVÁ, F. MACHÁŇ

The study of selected cereal genetic resources began in the Agricultural Research Institute Kroměříž, Ltd. in 1952. At present, the collection comprises 5,127 accessions among them 368 accessions of domestic origin.

The study of collections of the selected cereal species, i.e. wheat, spring barley, rye and oats, is conducted with objectives similar to the study of other plant species. Methods of the study are also similar, although there are some specificity in the research, order of priorities and the way research projects are conducted on individual crops. For newly acquired resources, passport data are obtained and included in the information system EVIGEZ. The current collections are increased with new resources, during the last 8 years (1990-1997) was mean increase 222 samples per year. Seed samples are provided for long-term conservation in the gene bank.

Winter and spring wheat

Wheat ranks among the most important cereals in the Czech Republic when considering its economic position, sowing area and grain production. In 1994, the wheat collection comprised 5,159 accessions of winter wheat and 2,778 accessions of spring wheat. Based on the agreement on unified registration, the wheat collection is held in the Gene bank at RICP, Praha-Ruzyně. Working collection is simultaneously studied in the Agricultural Research Institute Kroměříž, Ltd. Newly obtained resources are classified on the basis of taxonomic analysis, and studied in field experiments that include tests for reactions to specifically chosen diseases. Grain yield is analyzed considering basic quality parameters. The goal of all activities is to use the collection purposefully, i.e. to select suitable resources for crosses in breeding, in research and breeding programs.

The effective utilization of initial resources is proved by pedigrees of new registered varieties. Development of new intensive varieties possessing defined traits requires the use of specific resources. That is also confirmed by faster changes in the variety assortment. While a wheat variety was grown for 19 years between 1920 to 1945, it was grown only for 7 years in the 1960s and 1970s, and for 9 years in the 1980s and 1990s. There are some cases, however, when cultivars (Regina and Zdar) have been grown for more than 15 years.

While old varieties were mostly selected from landrace populations, modern high-yielding varieties are developed using a combination of crosses of domestic and foreign varieties. In the 1960s and 1970s, the first important genetic resources were Soviet varieties of winter wheat, mostly with Mironovka background, especially for their high grain quality, winterhardiness and adaptability. Western-European ecotypes were used as sources of productivity and resistance to diseases. In the last decade, a better yield potential has been achieved by considerably shorter stem and increased harvest index. One of the factors which limits grain formation is increased spike sink capacity. Therefore, genetic resources of the SFG type, "Spike Fertility Genes", which are classified in various groups depending on morphological spike structures, are of a greater interest now. A number of promising resources have been developed cooperatively with the Dept. of Genetics and Breeding in ARI Kroměříž.

The area sown to spring wheat is relatively small in the Czech Republic. Its average proportion of the total wheat area was 3 % during the last 5 years. The average grain yield is 17 % lower than that of winter wheat. Accordingly, there are fewer maintained collections and work capacities. Besides domestic sources, Czech productive varieties have been developed by using Western-European high-yielding varieties, and Mexican genotypes as sources of earliness, specific resistance to diseases and bread-making quality. Durum wheat, *Triticum durum* Desf., is interesting since the potential introduction of foreign varieties may ensure raw material for pasta production. As a rule, winter forms exhibit low winterhardiness and higher susceptibility to ear diseases. The low yield, 60 % to 80 % of that in soft wheat, is also a problem in spring durum types. *Triticum spelta* is analyzed for specific quality traits. Similarly to durum wheat, foreign genotypes are studied.

Spring barley

The study and maintenance of the spring barley collection is well-founded and is based on a long-term tradition of growing and breeding malting barley in the Haná region. Most varieties rank among world-known, generally acknowledged standards of quality. They have been developed from Haná varieties or through them, e.g. from Proskowetz Hanna Pedigree and Kneifls barley. The collection contains barley from more than 70 countries of the world, and includes 69 botanical varieties of three *Hordeum* species. Newly registered foreign varieties, new lines and semi-cultivated forms from all accessible regions of breeding and growing spring barley are tested in 2-3 year cycles. To ensure the greatest genetic variability we have exchange agreements with institutions in South and North America, Africa, Australia, Japan, and others. Thus, the collection represents a wide genetic potential when suitable initial components considerably affect the effectiveness and success of the breeding process. The collection includes resources or donors of resistance genes to powdery mildew, leaf rust, net blotch, smut, leaf stripe disease, and others. Although most genes have lost their effectiveness, this group of resources is important for the possible combination of resistance genes. There are also donors for other agronomic traits such as high 1,000-kernel weight, short stem, well-developed and efficient root system, high-yielding ear, high lysine content, etc. The study of the collection is aimed at the selection of materials which are of interest for specific requirements of barley breeding, and at the detection of varieties that could be introduced and enrich the Czech variety assortment with some traits.

Phenological and morphological observations, descriptions, evaluation of stand structure, yield components and the status of health are carried out according to the national Descriptor list of the Genus *Hordeum* L. (Lekeš et al. 1986) and to Descriptor list UPOV.

There is a database JEČMEN (Barley) at the Agricultural Research Institute Kroměříž, Ltd. which is the basis of registration of the spring barley world collection. It follows the EVIGEZ system and is comprised of basic passport data on the genotypes preserved characterization and evaluation data, data which cover important agronomic traits and properties, and morphological characteristics.

A database of literature sources on spring barley varieties called SEPARÁT has been established. It gathers not only the information on genotypes included in the world collection of the Institute, but also all available data on wild forms, landraces, registered varieties, breeding lines, gene resources and donors of various properties reported in foreign and home publications. This database is continuously being updated.

If the UPOV database is used for genotype evaluation, it will be done based on the importance of breeding and registration tests. These databases will enable us to check the origins of genotypes in connection with the law on varieties, and particularly to legal variety protection.

Rye

The collection includes a total of 693 varieties. Due to cross-pollination, winter rye requires specific maintenance compared to the other self-pollinated cereal species. To reproduce and maintain the viability of small quantities of seeds of cross-pollinated varieties, technical isolators are used. However, seed production in these isolators is accompanied by higher infection by fungal diseases, increased lodging of weakened plants, formation of smaller grains, etc.

Rye is a cereal species, which is grown specifically for bread baking, i.e. for direct human nutrition. In many lots, bread-making quality is considerably reduced by grain sprouting. Baking quality depends mainly on the alpha-amylase activity. Studying the winter rye collection, we have detected genotypes, which have a baking quality similar to the international standard, the Swedish variety Otello, but at the same time they possess a complex of other important agronomic traits.

A long-term problem, which has not been solved sufficiently so far, is resistance to lodging. To improve this trait, shortening the stem length appears to be logical. During the study of genetic resources of winter rye three groups of genes have been detected which considerably shorten stem length. Only two groups have been used in breeding practice, namely recessive and dominant dwarfness. Recessive dwarfness is conditioned by a larger number of recessive genes and is utilized in most current European varieties. Dominant dwarfness is based on one dominant gene EM-1 and is widely used in new varieties

developed in the former USSR. The problem of lodging resistance can also be alleviated by using hybrid varieties.

The rye collection at the Agricultural Research Institute Kroměříž, Ltd. is registered within the EVIGEZ program called ŽITO (Rye). It is evaluated according to the Descriptor list for UPOV and the Descriptor list Genus *Secale* L. (Macháň et al. 1986).

Oats

The oat collection contained 1,926 accessions in 1997. They are evaluated particularly for grain yield and its components, grain quality, resistance to diseases, lodging, time to maturity and other important agronomic traits.

Grain yields of Czech spring oat varieties studied in the collection have been comparable with the world level in recent years. They have ranked among the best varieties under both our conditions and elsewhere. Results obtained during the last years show a considerable yield increase, particularly in European varieties. New varieties released after 1990 give medium to higher yields, and in comparison with foreign genotypes they are earlier, have better disease resistance and a good proportion of hulls.

Evaluation of oat quality is specific because it is used primarily to feed farm animals. Therefore, it is important to determine grain crude protein and the most important essential amino acid in protein, lysine. For energy the grain fat content is of great importance; its proportion in hulless oats is higher than 10 %, which puts naked oat among the oil crops. For animal feed and direct human nutrition a proportion of fiber and beta-glucan content in grain are important. A lower proportion of hull is characteristic particularly for varieties from Scandinavia, i.e. Norway, Sweden and Finland. These varieties are of interest to breeders also for being early. High protein and amino acid content appear mostly in forms of wild oat.

Approaches to breeding naked oats are different in individual countries. In some, this problem is not addressed because the hulls (which are taken off while dehulling regular hulled oat) are considered a raw material which can be processed further. Conservation of naked oat seed requires more careful handling (it is necessary to reduce grain moisture and storage temperature), but particular care has to be taken to avoid possible damage to the kernels during harvest, which would cause them to turn rancid sooner or to loose their viability.

A collection of current varieties shows a low variability in disease reaction. Larger differences in this reaction are observed mainly in wild species. Recently, the resistances from such material have been built into commercial varieties in the USA, Canada and Australia.

The oat collection, similarly to rye, is registered within the EVIGEZ program called OVES (Oat). The evaluation is carried out according to the Descriptor list UPOV and National Descriptor List for Genus *Avena* L. (Macháň et al. 1986).

Conclusions

The study of genetic resources is inevitable and is related to research projects of genetics and breeding methods, grain quality, plant immunology, physiology and biochemistry. The findings are used by breeders who can propose new directions in gene resource investigations to let these contribute to a better utilization for breeding goals. The findings can also be used directly in variety testing, in particular in connection with international conventions of UPOV and the application of the law on variety protection.

Extensive international cooperation has been developed within the ECP/GR, Barley and *Avena* Working Groups. This program enables gene banks to cooperate and exchange seed and information between participating countries. Among countries, which are not members of the EU, the Agricultural Research Institute Kroměříž, Ltd. participates in the project Barley Genetic Resources - European Database. We carry out tests of winter rye varieties coordinated by EUCARPIA. We are in contact with world gene banks and breeding institutions with the purpose to acquire and exchange genetic resources.

Table 1 Collections of selected cereals in ARI Kroměříž, Ltd., 1997

Crop	Number of varieties		Increase in 1997
	total	from the CR	
Spring barley	2 508	181	43
Winter rye	693	41	6
Oats	1 926	146	23
Total	5 127	368	72
Winter wheat /**	152	30	113
Spring wheat /**	90	5	12

/** working collections

AGRITEC - RESEARCH, BREEDING AND SERVICES, LTD. , ŠUMPERK

THE CZECH COLLECTIONS OF LEGUMES, FLAX AND THE INTERNATIONAL FLAX DATABASE

M. PAVELEK - Flax; M. HÝBL - Legumes

The germplasm of grain legumes at AGRITEC was assembled in 1961 from collections held by breeders and State institutions and included 13.5% original Czech origin (landraces, breeders lines and cultivars). Recently, large numbers of accessions have been introduced from overseas institutes and international research centers.

Flax germplasm conservation has an old tradition in the Czech Republic and the flax collection belongs to the largest in Europe after the flax collection in VIR, St. Petersburg. The flax collection in AGRITEC holds 1973 genotypes of which 515 are landraces and primitive forms, 985 cultivars, and 473 accessions are breeding material. About 40 other species of *Linum* and other fibre plants are also held for different uses. The national collection operates as an active collection for breeders in the Czech Republic as well as abroad.

AGRITEC Ltd. is a co-ordination center of the International Flax Data Base (IFDB) since 1994. So far, 1385 original flax genotypes of 14 contributing gene banks from the Czech Republic, Russia, Ukraine, Rumania, Bulgaria, France, The Netherlands, Germany, Northern Ireland and USA are included in the IFDB.

Numbers of Accessions in the Grain Legumes Collection

Pisum spp.	1.124
Vicia spp.	666
Phaseolus spp.	321
Glycine spp.	211
Lupinus spp.	66
Cicer arientinum.	41
Total	2. 431

Structure of the Flax Collection According to Plant Type

Fibre	53 %
Mixed	8 %
Linseed	39 %

Structure of the Flax Collection According to Origin

Landraces	27 %
Advanced Cultivars	48 %
Breeders Lines	25 %

Linum usitatissimum	1973
together	4404

Maintenance of the Collection

Legumes: for short term storage in plastic boxes, at 15 ^{o}C and 40 % relative humidity; part in the Central Gene Bank at RICP, Praha-Ruzyně, for long-term storage

Fibre plants: *Linum usitatissimum L,* for short term storage in paper bags, at 15 ^{o}C and 40 % relative humidity; part in the Central Gene Bank at RICP for long term storage

Availability

Free, 50 seeds of grain legumes and 1000 seeds of flax per accession for research and breeding purposes.

Evaluation status

Legumes (*Pisum spp., Vicia spp.,Phaseolus spp., Glycine spp., Lupinus spp.)*

Collection includes: 2431 genetic resources; 26 passport descriptors and 32 descriptors of morphological and biological characters are prepared and used for evaluation.

Fibre plants (*Linum usitatissimum L.).*

Collection includes: 1973 genetic resources; 30 passport descriptors and 58 descriptors of morphological and biological characters are prepared and used.

IFDB includes: 1385 genetic resources, 22 passport descriptors and 24 descriptors of morphological and biological characters presented at the Second Workshop of the Breeding and Research Group, FAO FLAX NETWORK, held in the Czech Republic, November 8 - 10, 1994.

Documentation

Passport data are computerized by software FOXPRO within the National Information System EVIGEZ. We continue evaluation of morphological and biological characters. These characters are evaluated on the base of UPOV descriptors for Flax and Legumes and expressed on a scale of 1 - 9 (1 - minimum level of expression, 9 - maximum level of expression). It is supposed to use the Least Squares Method (LSQ) in connection with the database for solution of non-orthogonal data obtained from field trials of varieties. The new database has better and easier data manipulation, and together with friendly software (LSQ) and spreadsheets that are compatible with DBF, it will be possible to relate all results to new standard varieties. The latter do have not to be present in all trials and localities.

Details of Catalogues

Catalogues on fibre plants and on legumes are published every year. The structure of these catalogues depends on user requests. The main passport descriptors are included, others including morphological and biological characters will be entered if users request them.

The first version of the IFDB catalogue was published with the following passport descriptors: year of entry into IFDB, origin, contributing gene bank incl. country, contributing gene bank number, plant type and availability.

Research Work Related to Evaluation

One quarter of the flax and legumes genetic resources is usually sown for evaluation and renewing seed viability. They are multiplied and tested in field trials and evaluated on the base of analysis of variance.

International Activities

The *Pisum* collection is included in the European *Pisum* database. Our company AGRITEC was made a Corresponding Member at the first meeting of ECP/GR Grain Legume Working Group held in Copenhagen, July 14-16, 1995. The Czech collection of the genus *Lupinus* became part of the international database held at Wiatrowo (Poland), and the *Phaseolus* collection became part of the international

database held at Linz (Austria). Our company is a member of the European information network NORLEG at the J.I.Institute in Norwich.

AGRITEC has co-ordinated the International Flax Database under the FAO Flax Network since 1993. The main activities were focused on the exchange of information and to arrive at a unified classification system for an International Flax Database. At the first meeting of the FAO Flax Breeding Research Group held at Poznan, November 1993, the structure of the International Flax Database was presented, including 22 passport descriptors. Further 14 descriptors for morphological traits, 5 for biological characters, and 7 of yielding parameters were presented at the second meeting of that Group held in Brno, November 1994. Of the 14 contributing gene banks, 1385 accessions are included in the IFDB at this time. The first version of the IFDB catalogue describing 1150 accessions was prepared and the principles for further work were proposed. An inventory of the database, identification of duplicate groups and preparing the second version of the IFDB catalogue for publication were the main topics of the last meeting of the FAO Flax Breeding Research Group held at Saint Valery en Caux (France), November 1995. The development of passport and evaluation descriptors and of methods to evaluate genetic resources and comparing them to standard varieties will be further activities by AGRITEC on the International Flax Database.

RESEARCH INSTITUTE FOR FODDER PLANTS, LTD., TROUBSKO

COLLECTIONS OF *FABACEAE* FORAGE CROPS

I. ZAPLETALOVÁ, J. PELIKÁN

The Research Institute for Fodder Plants Ltd., Troubsko is responsible for the project "The genepool of *Fabaceae* forage crops". The project is concentrated on four groups of genetic resources: main cultivated leguminous plants, minor forage crops, promising forage crops, ecotypes of cultivated species and wild species.

The general objectives, common to all groups studied, include basic requirements for work with collections i.e.

- acquisition of the most recent genetic resources from Czech and foreign partners or plant collecting expeditions with the aim to ensure the widest possible genetic diversity
- systematic study of genetic resources, their description and evaluation on the basis of field trials
- complete documentation of the genetic resources collected, creation of crop databases and preparation of passport and descriptive data following the guidelines of the National information system on plant genetic resources (EVIGEZ), input of metric data into the database of varieties bred at the Forage Crop Research Institute
- cooperation with the Gene Bank in RICP Praha - Ruzyně by long-term maintenance of seed samples of all genetic resources to meet present or possible future needs, and storage of a working collection at the Forage Crop Research Institute
- provision of seeds and information about genetic resources to users in the Czech Republic and abroad (research, variety trials, breeding, educational establishments, agricultural practice)
- continuous search for information concerning special problems

The specific objectives for each group of forage crops are as follows:

- Cultivated leguminous crops: to compare the level of yield and quality characters of the most recently introduced varieties with that of domestic and newly-bred varieties, possibly selection of donors of economic traits in selected materials.
- Minor and promising forage crops: to add new species to the present species spectrum in the collections of the gene bank.
- Ecotypes and wild species: to collect, prepare documentation and conserve resources of native origin.
- Selected species and ecotypes: to test their possible practical use as a prerequisite for their contribution to the diversity of the crop and variety spectrum in the Czech Republic.

In the major cultivated leguminous species, lucerne (*Medicago sativa*, *M. falcata, M. x varia)*, red clover (*Trifolium pratense)* and white clover (*T. repens*) the existing collections are systematically expanded with the most recent materials of foreign and domestic origin. The ongoing long-term collection and study of varieties of the crops at Troubsko, as part of state research projects, is continuing to progress. Since 1956, a total of 456 lucerne and 345 white clover varieties have been assessed in 13 experimental phases, and 349 red clover varieties in 9 experimental phases. This activity has become a precondition to improve the domestic assortment of varieties, and for further research or recommendations for importation of seed of the best foreign varieties. A close cooperation with breeders and variety testing organizations has resulted in the development and introduction of such methodologies that are still of great importance. All varieties are seeded and grown without a cover crop on microplots of $5m^2$. They are evaluated for morphological,

phenological and economic traits. Their performance is compared with that of the domestic control variety and by application of classification criteria.

Minor species include forage crops registered in the list of released varieties, but that are not so popular in present farming practice. They have not been assessed in field trials at the Forage Crop Research Institute, and they are not present in the gene bank and information system EVIGEZ. In 1994, seed was collected and in 1995-1997 domestic varieties of crownvetch (*Coronilla varia*), crimson clover (*Trifolium incarnatum*), alsike clover (*T. hybridum*), white sweet clover (*Melilotus alba*), birdsfoot trefoil (*Lotus corniculatus*), *Anthylis vulneraria*, and *Onobrychis viciifolia* were evaluated in field trials. Species from families other than *Fabaceae* such as *Phacelia tanacetifolia*, *Malva verticillata*, safflower (*Carthamus tinctorius*), *Borago officinalis*, *Sorghum dochna, S. sudanense*, *Plantago lanceolata*, *Coriandrum sativum*, *Trigonella foenum-graecum* and *Galega officinalis* were also included. The selection of traits and their evaluation in these species grown on small plots were based on methodologies of variety testing and published procedures developed for similar and related species.

To promising forage crops belong both, non-bred wild species and species with only a few varieties in the world collection. However, they are not yet utilized in the Czech Republic. In 1994-1997 perennial species of *Astragalus glycyphyllos*, *A. cicer*, *Galega orientalis*, zigzag clover (*Trifolium medium*), and *T. ambiguum* were evaluated under field conditions. Of annual and biennial species the following were evaluated: *Tetragonolobus purpureus*, *Trigonella coerulea*, black medic (*Medicago lupulina*), small hop clover (*Trifolium dubium*), *T. campestre,* white sweet clover (*Melilotus alba* f. *annua*), *Lotus ornithopodioides, Oenothera biennis, Lathyrus sativus* and chickpea (*Cicer arietinum*). The species were chosen on the basis of literature data or results of tests performed previously at the Forage Crop Research Institute. Their seed came from foreign botanic gardens, breeding and Seed companies and collections in nature.

Also the seeds from ecotypes of cultivated species and related wild species have been obtained through collecting activities at different localities (from natural undisturbed localities to semi-cultural, disturbed and polluted localities). These are ecotypes of popular cultural species (lucerne, red clover, white clover) or still minor species such as *Lotus corniculatus*, crownvetch, *Anthyllis vulneraria*, etc. and species not yet bred in the Czech Republic (zigzag clover, black medic, *Astragalus* etc.), which might be used in the future for specific purposes. The following lists the number of entries obtained:

Year	Number of collections	Number of localities	Number of samples
1994	23	20	223
1995	47	92	390
1996	24	45	222
1997	22	39	104
Total	116	196	939

Large samples of collected and purified seeds are assigned for direct supply to the gene bank. Other accessions are gradually propagated and subsequently will form part of the basic collection of the gene bank. Thus, 70 accessions were sown for regeneration in 1994, 264 in 1995, 302 in 1996, and 39 accessions in 1997. Since the majority of the species are cross-pollinating, regeneration can be carried out only in a isolator or in space isolation. This means higher demands for the size and location of field trials and equipment (cages, pollinators). Apart from the top priority, i.e. conservation of the widest possible genetic variability, it is expected that in the next years propagated seed material will be made available for research, breeding and commercial purposes (restoration of species-rich meadows, land reclamation in areas valuable from the viewpoint of species composition).

The following experimental specimens from four groups are presently being tested in field trials:

	1994	1995	1996	1997
lucerne - varieties	30	30	30+60	60+40
red clover - varieties	32	32	32	32+59
white clover - varieties	18	18	11123	11+23
other species and ecotypes	80	300	200+302	250+50
Total	160	380	273+385	353+172

The evaluation of minor and promising species is done predominantly on small plots of 5-10 m^2 under common agronomic practices. As in most species the seed is harvested from the first cutting, it is necessary to establish plots for forage crops and seeds. With respect to the character of crops evaluated (mostly perennial and multi-cut), basic evaluations (subjective evaluation using a scale of points, and metric assessment) are made. Ecotypes, or species with a small amount of seed obtained, are first evaluated in row sowings. After seed propagation a basic evaluation will be performed in small plot trials.

The basic evaluation of genetic resources is a major source of information for the characterization evaluation data of the information system EVIGEZ, where previously obtained data are completed by newly entered data, also in the passport section:

	1994	1995	1996	1997
EVIGEZ I (passport data)	130	250	300	250
EVIGEZ II (characterization/ evaluation data)	50	130	200	250

The installation of the EVIGEZ program on a computer at the Research Institute for Fodder Plants allows to provide the latest information to domestic and foreign users. It can also be used for presenting results in professional journals, lectures, workshops, exhibitions etc. Apart from seed samples requested, it is an important output of the work with genepools and is used in cooperation with research institutes, universities, breeding institutions, variety testing organizations and nature conservation bodies.

The most important objective of work with the genepool of forage crops is the long-term maintenance of genetic resources for future needs. Since the establishment of the Czech gene bank in RICP, Praha - Ruzyně, samples of original seeds have been recorded in protocols and included there into an active and a basic collections. Sixty entries were transferred in 1994, 250 in 1995, 300 in 1996, and 250 entries in 1997. Apart from this, the air conditioned storage rooms of the Forage Crop Research Institute (+4°C) hold about 1,100 samples as part of the working collection, of which most do not meet the criteria for inclusion into the gene bank at RICP (low germination, low sample volume) and will be regenerated in due time.

Within the framework of international cooperation, including exchange of information and seed samples, attention has been given to re-establish cooperation with some countries, such as members of the former COMECON, and to establish new contacts with institutions in countries that have a highly developed production of forage crops. As for database systems, in collaboration with the gene bank RICP the personnel is preparing European catalogues of lucerne, red clover and white clover cultivars.

RESEARCH AND BREEDING INSTITUTE OF POMOLOGY, LTD., HOLOVOUSY

GENE BANK OF FRUIT-TREE SPECIES

F. PAPRŠTEJN

The bases of collections of fruit species in the Research and Breeding Institute of Pomology at Holovousy were taken over from the first official national collections in Czechoslovakia, which had been established in the 1930-s at Újezd near Průhonice and Chotěbuz near Průhonice. In recent years, a reorganization of variety collections has taken place that makes it possible to do a more efficient evaluation. Mostly two or three trees of each variety were planted without replication. Two standard cultivars were scattered throughout the collection orchards by a chessboard arrangement as the basis for future statistical appraisal. Cultivars were placed in rows according to their time of ripening. This procedure makes evaluations and sampling during harvest time easier and faster. With apple-trees, besides this basic scheme, a special planting with only one tree per cultivar was established, where no chemicals are being applied. This orchard supplies information on the resistance of varieties to diseases and pests and their suitability for alternative systems of growing. The germplasm orchard of apples was planted in 1986, that of pears in 1984, sweet and sour cherries in 1989, plums in 1982, hazelnut and rowan in 1992, and walnut in 1991. Because our genetic resources are clonal, these collections are planted on an area of 21.3 ha. The present state of the field collections is given in Table 1.

Morphological, biological and agronomic characters are being routinely evaluated in the orchards. In some cases, special studies of characters are done in the nurseries. For these purposes descriptors were developed at RBIP Holovousy; they were based on previous research projects. In some cases international descriptors issued by IPBGR 1984-1989 or descriptors of UPOV are utilized as well. Collected data are handled numerically by computers.

The health of all cultivars in field repositories is monitored by ELISA tests. The following fruits are tested for: apples CLSV (Apple Chlorotic Leaf Spot Virus), ApMV (Apple Mosaic Virus), SGW (Stem Groowing); cherries PDV (Prune Dwarf Virus) and PNRSV (Prune Necrotic Ringspot Virus); plums PPV (Plum Pox Virus), PDV , PNRSV and CLSV; strawberries ArMV (Arabic Mosaic Virus), RRV (Raspberry Ringspot Virus), SLRV (Strawberry Latent Ringspot Virus) and TomBRV (Tomato Black Ring Virus).

International collaboration

Entries to increase the collections are selected on the ground of literature surveys. Exchange of genetic resources is based on direct collaboration with partner organizations abroad. Thus, we collaborate with institutions in the following countries: Austria, Belorussia, Belgium, Bulgaria, Canada, China, Denmark, France, Germany, Hungary, Italy, India, Japan, Lithuania, Macedonia, Moldova, Netherlands, Norway, New Zealand, Poland, Romania, Russia, Slovakia, South Africa, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, USA and Yugoslavia. During the last 5 years, 336 cultivars were imported and 423 exported. The increase of exchange in recent years is due to exchanges of accessions with collections in Slovakia.

RBIP Holovousy takes part in the *Prunus* working group of European Cooperative Program. By collaboration, the European *Prunus* Collection is being organized and developed, and the European *Prunus* Database is being built. For this purpose, all passport data on the majority of cherry and plum varieties that are maintained at Holovousy have been sent to the coordinator of the project (INRA, France). The next steps aim to improve and update the European *Prunus* Database so that it is accessible through an international network, and to define agronomic characters and evaluate the accessions.

We are further involved in the establishment of the *Malus* and *Pyrus* working group of the European Cooperative Program. We supported this new international project and supplied the necessary information to the coordinator. The status of apple collections in all European countries has been reviewed and possibilities to harmonize it further have been outlined. The establishment of a central European *Malus* database is also planned. New important breeding aims were discussed, and suggestions to update some apple descriptors should be considered in the near future as well. Through several of its members, RBIP at Holovousy is also involved in the section of Fruits of EUCARPIA.

Collecting of landraces.

Since the Middle Ages, the territory of the Czech Republic has been very important for the development of new cultivars of woody fruit species. This is testified by a great number of local varieties and landraces, which were predominantly grown until the beginning of this century and they are still grawn in old orchards and house gardens. Some of them won recognition abroad, for example the cultivar of apple ´Malinové Holovouské´ received the first price as the best apple at the International exhibition in Vienna 1888. The development of the old varieties was a rather spontaneous one, and a consequence of the high density of fruit trees and the long tradition of their growth here. This immense genetic richness was in the past a frequent object of interest by many important pomologists (Rössler, Proche, Bláha, Říha, Kamenický).

The priority is now to save and preserve the old landraces, which prove to be valuable genetic material. Unfortunately, their origin is unknown since they arose accidentally like unknown seedlings, but because of their advantages were propagated and spread. These landraces are as a rule perfectly adapted to local soil and climatic conditions. Some shortcoming could be that their breeding behavior has not been studied yet. In the last 50 years, many old landraces have been replaced by modern cultivars, which generally have better fruit quality. There is a danger that many landraces will disappear soon. Therefore, a special project has been set up which in the first step will identify and then collect all the landraces of fruit species that can be found. Some old pomologists were involved in the project because their knowledge proved to be irreplaceable. The public too was asked for help and encouraged to send samples of fruit to RBIP at Holovousy. On the basis of such samples, many old landraces were identified and collected for the research nursery at Holovousy. After growing in the nursery, the material were gradually transplanted into germplasm orchards and evaluated like other genetic resources. Besides, several short-time expeditions into some areas were organized to collect the landraces e.g. in the surrounding of Molitorov, in the Šumava and Krkonoše regions.

In the last few years we appropriated hundreds of landraces and local varieties of all fruit species and we planted 158 new accessions into germplasm orchards. Besides these we have about 150 interesting accessions registered "*in situ*".

Information system on germplasm of the main fruit species

The ultralight PC Olivetti Quaderno was tested as a data-collector during the 1994-1995 growing seasons in orchards of the gene bank of fruit-tree species. This PC has a size of 210 x 142 x 32 mm and weight of 1050 g. Its fixed disk has a capacity of 20 MB. A restricted database program FoxPro was installed in the computer. It works as a diary for stored data. Also, a database has been installed that works as a detailed register for all orchards of altogether 25 ha at Holovousy. Another database was created for every fruit species, containing character descriptors in rating scales that can be directly used for evaluation. There is also a special notepad for notes on every accession that can be opened by a single keystroke. It is possible to find the site of every tree and cultivar, and/or retrieve past stored data, which helps to make the evaluation faster and easier. Data gathered in the field by the PC collector can be simply transferred into a normal PC by interlink. The database ISGOD has been developed in the program FoxPro 3.0 for Windows, which handles descriptive data on the variety, utilizing passport data from the EVIGEZ (Holubec, Hon 1991) program and also supplies information on the site. Passport data consist of accession number, botanical name, accession name, country of origin, donor of sample, ploidy level, origin, durability, accessibility of sample, year of collecting. Other information is relevant to breeding, i.e. breeder, pedigree, year of introduction, year of registration for growing and year of restriction. In the case of accessions and wild forms that have been collected in nature, the name of expedition, denomination of the accession, date of collection, site of collection including geographical co-ordinates, altitude and ecological characteristics. Descriptive data are based on descriptors for every fruit species. These descriptors make it possible to evaluate morphological, biological and economical characters. Depending on the fruit species, 100 to 150 different characters are being evaluated. The majority of the characters are described in 1-9 rating scales (9 is usually the best performance). Other characters are evaluated in absolute values.

The average value of every character for every year of its evaluation is entered into the database. Thus, the database program supplies information on the average value of a character, and on the extremes, with the years in which they occurred. For every character the descriptor, which was used for evaluation can be recalled by the program. Every accession in the database is also illustrated by a picture of fruits and the tree at harvest time. The apple collection has been evaluated longest; we have the data computerized since 1976. Sweet and sour cherries followed (with data since 1982). The data are used e.g. in breeding to choose parents for crosses, for appraisal of cultivars using a synthetic index, to study possible correlations between characters. (Paprštein, Blažek 1992).

Table 1 - Range of maintained genetic resources of fruit species at RBIP Holovousy

Fruit species	Total number of accessions	Among them landraces
Apples	1 021	229
Pears	132	21
Sweet cherries	303	9
Sour cherries	108	8
Plums	232	15
Hazelnuts	17	-
Walnuts	16	-
Rowans	11	-
Strawberries	67	
Raspberries	62	
Total	1 969	282

POTATO RESEARCH INSTITUTE, LTD., HAVLÍČKŮV BROD

GENETIC RESOURCES OF POTATO *(Solanum tuberosum* L.)

J. DOMKÁŘOVÁ

Starting 50 years ago, work on potato germplasm became part of the research at the Potato Research Institute, Havlíčkův Brod. At that time, a world assortment of varietes in the form of field collections was established. This collection was gradually improved and extended by newly obtained varieties. However, a fast-spreading and -acting virus infection led to the exclusion of many varieties from the field collections every year. In the meantime, they had become a source of infection for other materials. For this reason, a transfer of collections was started at the end of the 1980-s. This included more than 600 varieties at the time. The collections where transferred into the gene bank *in vitro* and, therefore, a new system of registration, evaluation and maintenance of potato germplasm was worked out.

The bulk of the maintenance of variety samples has been transferred into the gene-bank *in vitro*, where the plants are cultivated at 10 ^{0}C. Media with a higher sucrose content, with slow microtuber induction, are used. The microtubers gradually form buds after several months of dormancy. After the shoots are formed they are put into fresh medium. This method of cultivation allows to maintain vital variety samples without transfer for lO-l5 months, and even without any risk of health deterioration and genotype loss.

In the gene bank of the Potato Research Institute, there are now maintained *in vitro* more than 879 foreign and 80 local Czech cultivars. This list is enlarged every year, and accessions are available to local and foreign research and breeding institutions, which can order genetic materials. Except for commercial varieties, there are maintained at the research institute sets of valuable tetraploid hybrids and dihaploids *S. tuberosum*, representatives of cultivated and wild species of the genus *Solanum* and inter-specific hybrids. The extent of the complete germplasm collection recorded and stored *in vitro* in the gene bank of Potato Research Institute is given in Table 1.

Tab. 1. List of germplasm of the genus *Solanum* maintained in vitro in the gene-bank of the Potato Research Institute as of 31. 10. 1997

Genotype category	Number
Varieties, *S. tuberosum*	959
Tetraploid hybrids, *S. tuberosum*	160
Dihaploids and wild species of *Solanum*	92
Cultivated and wild species of *Solanum* - 23 species	219
Interspecific hybrids in the genus *Solanum*	55

Foreign cultivars are obtained as tubers through the Main Variety Testing Section of the Central Agricultural Institute for Control and Testing (ÚKZÚZ) in Lípa. For a complete germplasm collection, it is still common to either import or exchange samples with foreign partners.

Tubers of newly obtained genotypes are first planted in an isolation greenhouse. Plants grown there are tested for various strains of the viruses PVS, PVM, PVY, PVX, PVA and PLRV. They are also tested for quarantine potato spindle tuber viroid (PSTV) and for tuber ring rot (*Corynebacterium*). Explants are taken from these plants, to be transferred to *in vitro* storage in the gene bank. In the case of negative results from the disease tests, verified material is planted in the field study collection during the following year. There, economic traits, other traits important for breeding, and the reaction to pathogens under our conditions are evaluated.

Every year, 150-180 genotypes are grown under field conditions. They are evaluated for the following traits: uniformity in emergence, growth vigor, colour and number of flowers, pollen fertility, berry formation, health status in the vegetative state, tuber morphology and their infestation by fungus diseases, starch content, table value, suitability for chips and French fries production, blackening of raw potato purée.

Tuber resistance to mechanical damage, resistance to potato late blight, fusarium and wart diseases are tested, and resistance to potato nematode is evaluated. Traits are evaluated and recorded on a nine-point scale, where 9 is the best.

Samples of genotypes, information about them and other maintained genetic resources are provided to users of the collection (research workers, breeders, universities). Individual genotypes are provided as *in vitro* plants and/or as tubers from the field study collection. The number of genotypes provided to domestic and foreign users during the last years is given in Table 2.

Tab. 2. Number of samples supplied to users between 1990 - 1997

Years	Number of samples provided to	
	Institutions in the CR	Institutions abroad
1990	262	52
1991	193	15
1992	393	-
1993	353	-
1994	446	13
1995	221	5
1996	180	8
1997	347	39
Total	2 395	132

Every year, after harvest and tuber material analyses, users are given information on 1-year results about newly obtained genotypes. Two-year results are elaborated and published in a potato card-index. Hitherto, 1 528 varieties from 23 countries were thus described on a l5-part card-index. Data about the varieties are also transferred into the documentation system EVIGEZ on the gene bank in RICP, Praha-Ruzyně, where they are permanently maintained.

OSEVA PRO LTD., GRASSLAND RESEARCH STATION, ZUBŘÍ

PRESERVATION AND USE OF THE GRASS GENEPOOL

M. ŠEVČÍKOVÁ

Grasses (*Poaceae*) are a large and variable family including 266 species in the Czech and Slovak Republics (DOSTÁL, 1982). There are annual, semi-perennial and perennial species, and also cross and self-pollinated ones. The majority of them are widespread in grassland ecosystems, mostly in communities of natural and semi-natural meadows.

Only a small part, i.e. 22 species, of the grass genepool was exploited during Czechoslovakian plant breeding and agriculture. In the history of plant breeding, 101 varieties of grass were listed in the List of Registered Varieties for Czechoslovakia; 85 of which were established in the Czech Republic and 16 in Slovakia. Only one of them was a landrace, the others were bred varieties. Practical use of grass varieties is widespread, both for agricultural and for non-agricultural purposes.

- Grass is grown as a fodder crop in clover-grass or grass mixtures, as permanent grassland, pastures and meadows, or as an arable crop in a short-term rotation.
- Amenity grass varieties are suitable for lawn and turf usage for different purposes, e. g. for gardens, sports fields, landscaping etc. They play an important role in man's environment and for uses other than production of biomass. The number of newly released varieties is rapidly increasing worldwide.
- Seed production of various grasses for agricultural and other purposes is based on specific technology that is different from fodder production or planting new turf.
- Nowadays, we are looking for alternative uses of grass - for example biomass production for energy and electricity, usage of dry resistant species for roof covering etc.
- Specific groups of grasses are decorative species used for gardening, parks and architecture applications.

The first historical documentation about genetic resources of grass in Czechoslovakia is connected with the establishment of the Grassland Research Station in Rožnov p. R., mainly with the start of plant breeding. This activity included plant collecting of forage grass from semi-intensively managed sites of the local mountains Moravskoslezské Beskydy (BRADA, 1967). These ecotypes were the basic material for plant breeding. This activity was successfully finished with the release and registration of 14 original Rožnov varieties of grass in 1940. Seven of them are still listed in the List of Registered Cultivars for 1997.

The permanent study of genetic resources at the Grassland Research Station was continued after 1956 in different scientific projects of the National Research Agricultural Program. Since 1964, the study of genetic resources has been under the guidance from the Research Institute for Crop Production (RICP), Praha. Collection and evaluation of genetic resources was more oriented toward foreign varieties than local wild ecotypes. Thus, foreign materials were the base of the Czechoslovak grass collection.

In 1994, after the privatization of research institutes in the Czech Republic, the Grassland Research Station, GRS, (since 1982 with the seat at Zubří) became a trading enterprise, Oseva PRO Ltd. At that time there was a real danger of a restriction of the activities on grass genetic resources. Thanks to the National Programmeme on Plant Genetic Resources Conservation and Utilization, established by the Ministry of Agriculture and coordinated by Gene Bank of RICP, Praha, these activities can continue. The basic methodology of that Program deals with main problems and strategy such as: collection, basic characterization, documentation, long-term conservation and regeneration of germplasm collections. Special

emphasis is put on genetic resources of local origin.

Since the start of this decade the collection of genetic resources of grass has been oriented toward the original, endemic genepool of the Czech Republic. A complete change in the direction of our work has been made. Now we are looking for wild forms of agronomic important species, weed species included, from natural and semi-natural grassland communities. The major way to obtain genetic resources of grasses is through collecting expeditions. The main plan is to systematically visit the primary phyto-geographical districts of the whole Czech Republic so as to have a representative collection of the Czech genepool. Table 1 summarizes our expeditions.

Table 1 Collecting Missions Organized by GRS Zubří

Phyto-geographical region	Phyto-geographical district	Year of expedition	No. of items in the collector's diary
1. Thermophyticum			
1.1. Thermobohemicum	Lounsko-labské středohoří	1995	154
1.2. Pannonicum	Bílé Karpaty stepní	1993, 1994	235
	Podyjí	1997	66
2. Mesophyticum			
2.1. Mesophyticum Massivi bohemici	Českomoravská vrchovina	1999	
2.2. Mesophyticum carpaticum	Moravská brána	1998	
3. Oreophyticum			
3.1. Oreophyticum Massivi bohemici	Šumava	1994	198
	Krkonoše	1995	170
	Orlické hory	1996	94
	Slavkovský les	1997	96
3.2. Oreophyticum carpaticum	Moravskoslezské Beskydy	permanently	96

We will continue to keep contact with the most famous grass-oriented companies and gather new released varieties to preserve the variability of characteristics important to plant breeding, agriculture and many other purposes. We have recently established a collection of vegetatively propagated perennial grasses for gardening *(Cortaderia, Festuca, Miscanthus, Molinia, Panicum, Pennisetum* etc*).*

Documentation of genetic resources is done by the Gene Bank of RICP, Praha. It is responsible for the national information system EVIGEZ. In 1995 this database was released to our station to give passport information about genetic resources which are included in the actual collection to the central database. Description data are not yet sent there because of the absence of national descriptors for grasses. Basic metric data and non-metric (scale) data are deposited in our database. There were 1751 genetic resources documented in the passport database EVIGEZ by 1. 1. 1998. This collection is listed in Table 2.

Genetic resources characterization and evaluation is based on single space plants or row plots and according to practical use. Field plots arrangement is of two types - for forage and turf purposes. Characterization of field trials (by UPOV or IBPGR methods) is based on morphology and biological characteristics. Agronomic and turf features are being further evaluated in plots.

We have a special machine to artificially wear out playground grass. We can evaluate only a limited number of accessions by experiments for their ability to withstand mechanical destruction of the lawn.

Table 2 Grass collection in GRS Zubří

Genus	No. of genetic resources
Agrostis	43
Alopecurus	6
Arrhenatherum	19
Bromus	17
Dactylis	141
Deschampsia	9
Festuca	340
Festulolium	14
Lolium	732
Phleum	119
Poa	225
Trisetum	9
other species	77
Total	1 751

Regeneration of collections of grass genetic resources is difficult because they are cross-pollinating and of the wide presence of wild forms in the surrounding nature. It is necessary to do it either in technical isolation or distant from an unwanted of source of pollen. In our trials, field plots are isolated by the barrier crop *Triticale* combined with distance isolation. The species *Bromopsis erecta, Anthoxanthum odoratum, Holcus lanatus, Helictotrichon pubescens* that do not occur in the near neighborhood of plots for multiplication of seeds are grown without any isolation.

In 1995, the most extensive regeneration in our history was done on the collection gathered by the expedition in the Bílé Karpaty in 1993. Single-spaced plants of 60 genetic resources of grass and some restricted varieties were planted on an area of 0.5 ha.

Long-term preservation of collected seeds is ensured in the Gene Bank of RICP Praha, and samples of newly collected or regenerated genetic resources are submitted to it annually. At GRS only the working collection is stored (2536 specimens in manilla envelopes in a dry and cold room). Most of them are small, not yet registered regenerated and evaluated specimens of the wild flora. The vegetatively propagated collection of grasses for gardening has 70 specimens.

An important activity of the group of genetic resources is cooperation with institutions from the Czech Republic and abroad. We have excellent cooperation with the Plant Breeding Station Hladké Životice and Větrov, and we have transferred there the best-defined breeding material selected from the genetic resources for the next breeding programs. Other users of our results are scientific biological institutes, environmentalists, agriculture high schools or universities. After participating for 2 years in the National Programmeme we gave information and distributed seed of 351 accessions requested by users.

It is important that we join the working group coordinated by the Research Institute for Soil and Water Conservation at Zbraslav, which prepares the methodology to improve, maintain and establish wild floral meadows in the Czech Republic. The environmentalist's request to use only regional and genetically native material for revitalization projects was the beginning of collaboration with the Protected Landscape Area Bílé Karpaty. It gave the momentum to create the regional collection of grasses and herbs for that purpose. This collection is suitable for modeling a study of use and multiplication of genetic resources for species-rich meadows, their establishment in and revitalization of a landscape.

The most important international activity of GRS is participation in the European Cooperative Program for Crop Genetic Resources Network (ECP/GR). There the group for fodder crops is very active. For example, there is an international project aimed at the creation of a European core-collection of rye grass (*Lolium perenne*). This model collection will cover most of the genetic diversity existing in nature as

fast as possible. A detailed study of this collection should increase our knowledge about the genetic variability of *Lolium perenne* and its use for breeding of new varieties for agriculture. In the trial, 162 wild populations collected from 18 countries evaluated, being tested in the network of field trials at 20 locations of 17 EC countries together with the best varieties.

Another important activity of the working group is registration of all available information about genetic resources of the main grass species held in collections of European institutions. The main task is to identify and define unique resources, which need extraordinary attention, to reduce duplications in the collections and to make genetic resources accessible to international cooperation. In 1994 it was decided to update the older passport databases of grass at different European institutions. We gave data about Czech collections to the Nordic Gene Bank, Alnarp (*Phleum, Agrostis*), IGER, Aberystwyth (*Lolium*), IHAR, Bydgoszcz (*Dactylis*) and Malchow *(Poa)*. Our institute has a special commission for oat-grass (*Arrhenatherum elatius*) and yellow oat-grass (*Trisetum flavescens*). The first version of a European Catalogue of those species was issued in 1991. Currently, the data are being updated and the manual format is being computerized.

In past years, scientific and plant breeding institutions from abroad show an increasing interest in participating in collecting expeditions in the Czech Republic. This is due to the position of our country, spread over two different climatic regions, with great geological diversity, and considerable differences in altitude. That results in a large number of different phytocenological units of grassland and a high species diversity. In the past we organized international expeditions oriented on wild ecotypes of certain species - 1991 Barenbrug Holland, 1992 IGER Wales, and 1996 plant breeders from Japan. These expeditions are always important for the beginning of cooperation among participating institutions.

In 1995, we accepted an invitation for two persons of the working group of genetic resources from the Institute of Grassland and Environmental Research (IGER). We made a study visit to this most important European institute at Aberystwyth, Wales. We gained valuable information for working procedures and techniques in dealing with genetic resources of grasses. This information will be mainly used in work with wild grasses. There will be mutual consultation with the Institute on tasks that are coordinated by it within the ECP/GR program.

OSEVA PRO, LTD., RESEARCH INSTITUTE FOR OILSEED CROPS, OPAVA

GENETIC RESOURCES OF OILSEED CROPS

J. HAVEL

The start of agricultural research at Opava dates back to 1880 and is tied to the name Ota Kamberský, director of a winter school for farmers. The state agricultural research station started operations in 1921. In the beginning, research was oriented towards large-scale field crops, mainly cereals. No information exists from that time on oilseed research. The direction of research changed after the World War II. In 1957, it was decided to shift oilseed research to Opava from Kroměříž, where it had been done before. The collection of about 100 accessions was also relocated to Opava.

In 1989, an independent Oilseed Research Institute was formed from the original Oilseed Research Station. This new research institute is now part of the Oseva PRO Ltd. company. The research institute has three responsibilities: breeding, research and consulting. Thus, institute employees deal with breeding of oilseed varieties, the production of seed and planting material, and also commercial aspects.

The oilseed genetic resource collection has been maintained and systematically extended since 1958. Oilseeds for the temperate zone are collected here, especially those of the *Brassicaceae* and *Papaveraceae* families. The collection of alternative oilseeds of various families is also relatively large. An account of the collected plant species and numbers of accessions are shown on the enclosed table. The main crop in the collection is winter rapeseed; the poppy collection is also significantly large. Some other oilseeds from the genus *Brassica* - turnip rape, mustards etc.- are tested now as alternative oilseed crops with the idea to extend the number of grown crops.

The main purpose of the oilseed collection is to have and keep genetic material for research and breeding, which is the most significant activity of the institute. The long-term aim is to save old varieties and those near extinction for the future. It is not only important to keep the genetic material but also all information about it. Therefore, within the collected information there are valuable data about breeding aims and yield results from the countries where the genetic resources were obtained.

The standard activities are done in the genetic resources department, i.e. collecting, testing, long-term storage and regeneration of accessions to keep them viable or increase the quantity of seed. Collecting expeditions are not yet established while wild genotypes of the oilseed plants in the collection are unknown (rapeseed) or their crop is impossible to find (poppy). The collected genetic resources are kept in long-term storage at – 18^{o}C without loss of viability. Seed samples are provided on user's requirements.

The collections of oilseeds are comprised mainly of rapeseed, poppy and potential alternative oilseeds.

Rapeseed

Winter rapeseed is now the most significant and predominant oilseed crop of the temperate climate zone. The rapid development of breeding for quality in this crop demonstrates the priorities of genetic resources research. The latest materials have the greatest value from a breeding and research point of view, and to obtain such materials is the priority. The use of wild species and old varieties with different quality is limited today. Such materials contain a great number of undesirable dominant genes. To eliminate these genes in the breeding process is difficult and time consuming. However, these genotypes would have a specific value for radical changes of breeding objectives. It happened in the past for example when breeders turned their attention to breeding varieties with a low content of erucic acid and glucosinolates.

Testing of winter rapeseed genetic resources is also complicated because of the fast changes in demands for quality of this crop. Quality breeding (i.e. breeding for absence of undesirable, anti-nutritional compounds, and for changes in the proportion of fatty acids in the oil) makes major progress. Tests are to obtain only the base characteristics for genetic resource description and use.

The actual description of gene resources of winter rape is also a great problem. The main differences between accessions are seed yield and quality. Some differences can be observed in plant height and phenological features. It is practically impossible to find morphological differences. It is true that 99% of the collected gene resources are morphologically so uniform that the description using the existing descriptor applies generally. Only a very small number of accessions have a distinctive morphological marker such as the overhanging siliques or anthocyan color. Therefore, electrophoretical methods of protein and isoenzym analyses are now of main interest. Unfortunately, these methods are not yet sufficiently developed.

Poppy

Poppy (*Papaver somniferum*) is from farmers point of view a relatively significant crop. In the Czech Republic attention is paid to poppy research and breeding. The varieties in the collection are mainly from Europe. An interesting find is that only Czech and Czechoslovak varieties have a nice blue seed color. Seeds of other poppy varieties are mainly gray. Seeds can be also white, yellow, pink, violet, brown or dark. The same variability is found in flower color - it can be white, pink, red or violet. The basal spot on the petals has the same variability. Flowers with a white base and pink frayed border are especially nice (cv. Pulawski bialy from Poland). The morphological description of poppy varieties is not too problematic due to great intervarietal variability. There are no rapid changes in quality of poppy (as in rapeseed); therefore, it is possible to do proper tests. One problem with this crop is that the number of new varieties is minimal in the last 10 years. The other species of *Papave*r do not have practical research and breeding importance.

Potential alternative oilseeds

Recently, interest in this plant group has grown significantly. The reasons are interest for natural sources of raw materials and the overproduction in other crops. The old oilseed crops such as mustard, false flax, oilseed radish, oilseed gourd, the wild plant species of evening primrose (*Oenothera* sp.), *Borago officinalis*, *Euphorbia* sp., *Cuphea* and *Limanthes* are being collected and tested. It was discovered that seed of many of these species contain oil with a very specific composition that can be used for the food industry (false flax, oilseed gourd), oleochemical industry (*Euphorbia*, false flax), for medicinal and dietetical purposes (evening primrose, oilseed gourd, *Borago*) etc. These facts are significant for the entire collection. The significance has increased because of species, which were formerly of no interest. Therefore, the possibility exists to find wild forms with valuable features in this group, and collecting expeditions are planned, especially for *Oenothera* and *Borago*.

Oilseed Species in the Collection	No. of accessions
Brassica napus f. *biennis*	510
Brassica napus f. *annua*	157
Brassica rapa f. *biennis*	38
Brassica rapa f. *annua*	24
Brassica nigra	14
Brassica juncea	43
Sinapis alba	43
Camelina sativa	22
Crambe abyssinica	2
Carthamus tinctorius	4
Coriandrum sativum	1
Eruca sativa	2
Raphanus sativus var. *oleiferus*	6
Papaver somniferum	167
Coryllus avellana	15
Oenothera sp.	20
Cucurbita pepo	1
Other species	50

HOP RESEARCH INSTITUTE, LTD., ŽATEC

GENETIC RESOURCES OF HOP

V. FRIC, F. BERÁNEK, A. RÍGR, V. NESVADBA

Hop belongs to a group of plants characteristic to Czech agriculture. It has been grown in our country for more than a millennium, according to old documents. This tradition is naturally accompanied by work related to genetic resources.

In spite of this fact collections of original hop populations have been very limited in the past. As early as the 20th century, a collection of original genotypes was grown at a research station at Deštnice. Hop varieties from six states (England, Germany, Poland, Belgium, USA and Yugoslavia) were imported in 1931 and an assortment of 36 genotypes was established (see Table 1). This initial collection of genetic resources was used in hop hybridization. The collection became much richer in the 50th, at the time when the hop research station moved from Deštnice to Žatec, where a new institute was established, now the Hop Research Institute, Ltd.

Collecting, study and conservation of wide intra-species variability represented by genotypes of Czech and foreign origin are is the main objectives of work with the hop collection. Genetic resources are represented by the following plant materials:

- bred cultivars, gathered at various times
- original and old cultivars
- other biological material (wild plants, newly bred lines)

Newly obtained accessions are combined in series and evaluated for at least 5 years. The evaluation follows the hop descriptor list. Usefulness of individual genotypes is determined after evaluation. They are either applied directly in breeding or later during other genetic studies. Then the genotypes are transferred to long-term preservation.

Genetic resources of hop are preserved in field collection. Each genotype is grown in a group of 8 to 24 plants. There is no safe duplication in the CR or abroad. In 1997, the hop collection consisted of 289 genotypes from 23 countries. All agricultural hop types are represented in this collection, but aromatic and fine-aromatic varieties predominate. For the practical reasons, the collection is divided into an evaluation and repository parts.

Our results confirmed that each genotype belongs to a characteristic type of hop, and proved also the uniformity of genetic origin within characteristic groups. Fine-aromatic hops (Osvald clones No. 31, 72 and 114, and cultivars which have their origin in Žatec semi-early red bine hop - clone No. 18, Žitomírský 5 and 6, Lublinský) belong to the group with a yield of 2 kg of fresh hops per plant. The varieties Wye Target, Brewers Gold, Columbia and Late Cluster belong to the group with a yield higher than 3 kg of fresh hops per plant. The American variety Talisman has the highest average yield (4,15 kg/plant). Our new cultivar Sládek belongs also to the group with high yield (3,59 kg/plant).

The best genotypes have on average a content of bitter alpha acids higher than 6%. Aurora, Atlas and Wye Target belong to this group. So does the English variety Wye Viking, which, unfortunately, has a lower yield. Fine-aromatic hop varieties belong to the group with the lowest content of bitter alpha acids.

There are 40 genotypes from nine countries of origin in the evaluation part of the genetic resource collection (Series V). Only the most important production characteristics are reviewed here from the years 1991-1995. The average yield of all entries in the collection (2,68 kg of fresh hops/plant) was surpassed by 18 genotypes, and 15 of these have a yield higher than 3 kg/plant. The following cultivars belong to this group: Yeoman, Omega, Zenith, Spalter Select, Hersbrucker Pure, Nugget, Eroica, Chinook, Olympic, Comet and Galena cultivars (the last had the highest yield 3,98 kg/plant). Our newly breed cultivar 3060 also belongs to this group. Its average yield was 3,60 kg /plant and the variability between years was relatively low (Vk 24,44%).

The average alpha acids content (4,48%) was surpassed by 16 cultivars, and 10 of them belong to the group with a content higher than 6%. Orion, Braustern, Magnum, Nugget, Galena, Chinook and especially Yeoman with 9,21% alpha acids and low variability (Vk 15,20%) are the best ones. Our new cultivar 3060 had absolutely the highest yield in the collection in 1991 (12% of alpha acids).

The collection of genetic resources of hop in Žatec is very important also internationally. Many visitors from around the world interested in hop cultivation come every year to our Institute to see this unique collection. The collection is also source to complement or establish foreign collections. Samples of hop cones from the collection are provided to users and given to universities for study and research work. It is also a workplace for training and study of our hop experts.

Table 1: Development of the collection of hop genetic resources

Year	Number of resources	Czech cultivars	Foreign cultivars	Number of countries	Location of collection
1931	36	19	17	6	Deštnice
1954	52	26	26	7	Stekník
1960	84	43	41	10	Žatec
1965	92	43	49	10	
1970	148	45	103	14	
1975	171	50	121	14	
1980	216	50	166	17	
1985	239	52	187	20	
1990	260	54	206	21	
1995	275	61	214	23	
1996	289	65	224	24	
1997	299	71	228	24	

**MENDEL UNIVERSITY OF AGRICULTURE AND FORESTRY BRNO,
FACULTY OF HORTICULTURE, LEDNICE NA MORAVĚ**

COLLECTION OF APRICOTS

Z. VACHUN

The Horticultural Faculty of the Mendel University of Agriculture and Forestry works on conservation and utilization of genepools of fruit species that need warmer climate, especially apricots and peaches. A suitable climate and good soil conditions exist at Lednice. Also, there are specialists who are experts in these fruit species.

There is a long tradition of selecting, collecting and evaluating genotypes of apricots at the Horticultural Faculty. South Moravia is the region with the highest concentration of apricot orchards in the Czech Republic. The Institute of Pomiculture and Viticulture of the Horticultural Faculty has collected and studied cultivars of peaches and apricots from many countries since 1960. The size of this gene bank is increasing, and it is used for the exchange of genetic resources (Italy, France, Spain, Ukraine, Hungary, Slovak Republic and other countries). A list of the present germplasm of apricot genotypes is shown on Table 1.

Tab 1. Origin and number of genotypes of *Prunus armenica* L. at Lednice in Moravia

Country of origin	Number
Czech Republic	128
Former Soviet Union	60
USA	37
Canada	17
Italy	12
China	12
Hungary	5
Slovak Republic	4
Other countries	89
Total	364

Studies of this germplasm have shown that 30 % of the genotypes grow more vigorously and 38 % less so than the control variety Velkopavlovická. The amplitude of the phenophase to the beginning of ripe picking is 88 days in total. The germplasm contains genotypes more resistant to abiotic and biotic pathogenic factors, such as frost and diseases (e.g. *Gnomonia erythrostoma* Pers. ex. Fr. (Auersw), Plum Pox Virus (PPV) and *Monilia laxa*). Some cultivars have winterhardiness of blossom buds. The average mortality rate is not higher than 35.1 % (Lejuna, Leala, Leskora, Karola cultivars) in years of severe climatic conditions, in comparison to the control (Velkopavlovická) at 70,4 %. There are also plum pox virus resistant cultivars: Harlayne, Henderson, Veecot, Stark Early Orange and Leronda. Detailed research has revealed that the variability of traits makes it possible to select usable genotypes that by crossing will reassort valuable traits and lead to new, superior cultivars.

Tab. 2. Maximum and minimum values of some traits as related to the control (cultivar Velkopavlovická) in the apricot germplasm.

Trait	Control	Trait value	
		minimum	maximum
Growth vigor	100	62 (Rodina)	230 (Olimp)
Start of blossoming (days)	0	- 7 (Rodina)	+ 8 (Tilton)
Start of picking Ripeness (days)	0	- 29 (Bukurija)	+59 (keč-pšar)
Productivity (scores)	5	2 (Badami)	8 (Leala)
Fruit weight (g)	51	14 (M 101)	96 (C4R8T22)
Fruit taste	8	2 (Badami)	8 (Legolda)

COLLECTIONS OF PEACHES AND ALMONDS

I. OUKROPEC

The Czech Republic has only a few areas with the climate suitable to grow peaches. Among them, the most important areas are in Southern Moravia, especially the region around the city of Břeclav. A large collection of peach genotypes is located in the Mendeleum, in the research department of the Horticultural Faculty at Lednice na Moravě which belongs to the Mendel University of Agriculture and Forestry in Brno.

Due to the introduction of new varieties, many fruit companies specialized during the 1960s in growing peaches. Old varieties, mostly whiteflesh ones, almost vanished. Also, the number of trees of semi-cultural vineyard seedlings rapidly decreased.

Collection in Lednice na Moravě started in 1991-1992 to develop with following goals:

1. to preserve cultivars and genepools grown in Southern Moravia;
2. introduction of new interesting genetic resources from abroad and testing their adaptability to local environmental conditions;
3. to duplicate the collection of varieties from Slovakia.

During the last years, the collection was increased by new peach and almond varieties from Italy and France. It is in the developmental phase and most items will be characterized. Passport data are entered and first phenological traits are being described.

The transfer of collection from Slovakia started in 1994 and still continues. A part of the costs is provided by the Mendeleum (Horticultural Faculty) through its economic activities. It is also desirable to protect the peach collection against PPV through technical isolation and testing by ELISA equipment.

Services for users could so far only be provided to a limited extent, due to the process of building the collection and the danger of misidentifying a requested sample. After a comprehensive identification of all accessions in the collection, most of them will be available to users. The present area of 2.2 ha for the gene bank will be enlarged to 3 ha, and 50 new items will be added to the present number of 300 (this includes probable duplicates that will be gradually excluded after identification).

New genetic resources of peaches will be increased by accessions from areas of their centers of origin, especially from Northern and Central China, the Far East and Central Asia. The aim is to enhance the genetic base of the collection and to preserve it for the future. Since we deal with short-lived trees (especially in the environment on the 48th parallel), this task is not so easy. The situation is complicated by virus diseases like PPV.

The collection, situated in an area of 1,6 ha of intensive peach orchards, is used by fruit growers, university students and other agricultural interests to study the large phenological variation of *Prunus persica.*

A small collection of almonds includes varieties adapted to Southern Moravia (they originated from different areas like the Crimea, Italy and from autochthonous collections).

Peaches collection (*Persica vulgaris* (Mill)) at Lednice in Moravia

Country of origin	Number of items
Italy	45
Czech Republic	44
France	43
Austria	35
Slovak Republic	10
Ukraine	9
Others	3
Total	189

COLLECTIONS OF VEGETABLES AND FLOWERS

K. PETŘÍKOVÁ et al.

Since 1994, the National Programmeme for Conservation and Utilization of PGR included the following facilities at Lednice of the Mendel Agricultural University: the Department of Vegetable and Floriculture Growing and the Department of Breeding and Propagation of Garden Plants. These two departments work on collecting perennial vegetables species and aromatic and medicinal plants: *Armoracia rusticana, Asparagus officinalis, Rheum rhabarbarum*, *Glycyrrhiza glabra* and tuberous plants: (*Canna indica*), and annual flowers: *Callistephus chinensis, Tagetes erecta, Salvia splendens, Zinnia elegans* and other species. All the mentioned species of vegetables are in the process of being collected, because all previously existing collections are no longer available.

During the first 2 years of this project we succeeded in collecting items as follows: *Armoracia rusticana* 17 accessions, *Asparagus officinalis* 8 accessions; *Rheum* 10 accessions.; *Glycyrrhiza glabra* 5 accessions In flower species about 100 accessions of the genus *Tagetes* were collected, over 40 accessions of *Callistephus,* and a small number of cultivars of the genera *Zinnia* and *Salvia* of Czech origin. Furthermore, we collected some plant material from the Czech Republic and abroad with resistance, especially against fungus diseases (FOC etc.).

In tuberous plants we have created a collection of about 20 accessions of the genus *Canna.*

RESEARCH INSTITUTE OF ORNAMENTAL PLANTS, PRŮHONICE NEAR PRAHA

GENETIC RESOURCES OF FLOWERS AND ORNAMENTAL WOODY PLANTS

J. TÁBOR, E. PETROVÁ , H. URBÁNEK.

1. GENETIC RESOURCES OF FLOWERS

The cooperation of RIOG with the Gene Bank of the Research Institute of Crop Production Praha (RICP) started in 1988, and developed fast after 1989. Many changes occurred at breeding stations, and the conditions for future genetic resources preservation (i.e. the results of scientific efforts of many decades) became uncertain. Thanks to the establishment of the National Programme of Conservation and Utilization of Plant Genetic Resources we have managed to gather the seeds of more than 400 flowers items. Regeneration is done on samples with reduced germinating ability. Seeds from the gene bank are sown, plants are evaluated and selected, seed is harvested and stored again in the gene bank in RICP Praha. We also developed a new list system of descriptors for selected flowers and filled in passport data (EVIGEZ). Records are being completed of other varieties, mainly older ones that could be valuable genetic material especially for resistance to diseases. The total amount of passport data exceeds 1, 000 items.

The group of generatively propagated flowers includes annuals, biennials, perennials and glasshouse plants. Significant or more numerously represented genera and species are *Anemone, Antirrhinum, Begonia, Callistephus chinensis, Cyclamen persicum, Dianthus, Lathyrus odoratus, Matthiola, Papaver, Pelargonium, Petunia* x *hybrida, Primula, Salvia, Tagetes, Viola* x *wittrockiana and Zinnia.* Most varieties of *Callistephus chinensis* came from the breeding station Libochovice, Lysá nad Labem, and from RIOG, Průhonice. Older low varieties of the group ”Průhonický trpaslík” are today offered by European and overseas seed companies, unfortunately under the name ′Pinocchio′. In glasshouse flowers, great attention was paid in the Czech Republic to the species *Cyclamen persicum, Primula vulgaris, Senecio cruenthus* and *Sinningia speciosa*. On the study of evaluated assortments, new F1 varieties of the genera *Begonia* and *Petunia* were bred by the company Černý at Jaroměř, and *Pelargonium zonale* and *Primula vulgaris* by RIOG, Průhonice. Vegetatively propagated flowers include annual plants, perennials and glasshouse plants. Many genetic resources belong to the group of bulb and tuber plants. At present, the foreign ornamental plants assortment for the Czech market is being evaluated.

There are newly bred species of *Kalanchoe blossfeldiana, Impatiens* New Guinea, *Dahlia pinnata* and *Gladiolus* that are in accordance with the contemporary world trend. The varieties are of high quality, and they are in great demand because of the high requirements for modern landscaping and decorations. RIOG, in cooperation with the company Bohemia Bulbs at Heřmanův Městec, takes part in the preservation of the increasing and promising genepool of bulb and tuber plants (*Dahlia, Gladiolus* and *Tulipa)*. A study of the world assortment was a base for breeding new varieties. The assortment of Czech dahlia varieties is traditionally comparable to the foreign one. Recently, the maintained Czech varieties of gladiolus and tulips have become interesting also for Dutch companies (e.g. the tulip 'Gavota'). In the study of bulb plants assortments there is special emphasis on the resistance to diseases; 570 varieties are in trials at present. The range of park dahlias, i.e. lower varieties that flower early and with a rich appearance and conspicuous inflorescences, seems to be promising. According to a study of an assortment of gladiolus, the Dutch varieties appear to be sources for good cultivation and have a greater resistance to virus diseases, while American varieties bring flowers of high quality. They are more firm and undulated. During 1982-87, tulip breeding was focused on higher resistance to virus diseases.

Assortments of more than 30 genera of perennials and decorative grasses, 14 genera of bulb, corm and tuber plants, and pot plants - pelargonium, fuchsia and chrysanthemum - were evaluated at RIOG. The result of this study was the recommended assortment of cultivated flowers under our climatic conditions.

2. GENETIC RESOURCES OF WOODY PLANTS AND PERENNIALS

Since 1992 the program FOXPRO2 was used for the database, and for data compatibility the international transfer-format (IFT). We started to use it first in 1987.

In 1995 the publication "Dendrological Garden of RIOG Průhonice" by I. Tábor and M. Součková was published. This publication follows previously elaborated lists of plants cultivated in the Dendrological Garden at Průhonice. The list published on occasion of the 26. Conference of Czech and Slovak Botanical Gardens in Průhonice (Genofond I /Genepool I/ - Tábor, Dvořáčková 1994) was used as a base. The genepool of woody plants and perennials (Genofond II /Genepool II/ - 09.1994), enriched with other accessions and corrections, follows it.

The nomenclature follows Krüssmann (1976-1978, 1983) and Rehder (1940). The genus *Rhododendron* was re-evaluated according to the International Register of the genus *Rhododendron.*

At present, 3,453 taxons of woody plants and perennials are cultivated in the Dendrological Garden. Other taxons that have not yet been entered in the list are being cultivated in stock areas, quarantine and cultivating areas.

The genus willow (*Salix)* was elaborated in detail. Gradually, smaller native and foreign species and cultivars were assembled here. The assortment of poplars (*Populus*) was also concentrated here because of the utilization of this genus in the landscape and areas severely damaged by coal mining. The Dendrological Garden takes pride in one of the biggest collection of pines (*Pinus*), spruces (*Picea*) and spireas (*Spiraea*). Step by step the collection of rhododendrons (*Rhododendron),* which Průhonice has become famous for, is expanding. A list of grown genera follows:

List of woody plants and perennials genera grown in RIOG Průhonice

Genus	No. of taxons	Genus	No. of taxons	Genus	No. of taxons
Abeliophyllum	1	*Aronia*	4	*Carex*	8
Abies	37	*Arum*	1	*Carpinus*	10
Acanthopanax	1	*Aruncus*	2	*Caryopteris*	1
Acer	118	*Asarum*	1	*Cassiope*	4
Achillea	1	*Aster*	9	*Catalpa*	5
Actinidia	5	*Astilbe*	9	*Ceanothus*	2
Aesculus	4	*Berberis*	55	*Cedrus*	6
Ailanthus	2	*Berchemia*	1	*Celastrus*	3
Ajuga	1	*Bergenia*	8	*Celtis*	1
Akebia	2	*Betula*	27	*Cerastium*	1
Alchemilla	1	*Brachypodium*	1	*Cercidiphyllum*	3
Allium	4	*Bruckenthalia*	1	*Cercis*	2
Alnus	12	*Brunnera*	1	*Chaenomeles*	24
Amelanchier	5	*Buddleia*	3	*Chamaecyparis*	80
Amorpha	1	*Buxus*	4	*Chelone*	1
Ampelopsis	4	*Calluna*	53	*Chionanthus*	1
Andromeda	5	*Calocedrus*	1	*Chosenia*	1
Anemone	3	*Caltha*	1	*Cimicifuga*	5
Anthemis	1	*Calycanthus*	3	*Claytonia*	2
Arabis	1	*Camassia*	1	*Clematis*	124
Aralia	1	*Campanula*	2	*Clethra*	2
Arctostaphylos	2	*Campsis*	4	*Colchicum*	7
Aristolochia	1	*Caragana*	5	*Convallaria*	1

Genus	No. of taxons	Genus	No. of taxons	Genus	No. of taxons
Cornus	22	*Hypericum*	7	*Parthenocissus*	8
Cortaderia	3	*Iberis*	3	*Paulownia*	1
Corydalis	1	*Ilex*	9	*Peltiphyllum*	1
Corylus	11	*Inula*	2	*Periploca*	1
Cotinus	3	*Ipheion*	1	*Perovskia*	2
Cotoneaster	12	*Jasminum*	1	*Petasites*	1
Crataegus	9	*Juglans*	7	*Phellodendron*	4
Cryptomeria	1	*Juniperus*	98	*Philadelphus*	33
Cyclamen	1	*Kalmia*	4	*Phlox*	1
Cytisus	13	*Kalmiopsis*	1	*Phyllitis*	1
Daphne	1	*Kerria*	3	*Physocarpus*	4
Dentaria	1	*Kirengeshoma*	1	*Phytolacca*	1
Deschampsia	5	*Koelreuteria*	2	*Picea*	108
Deutzia	7	*Kolkwitzia*	1	*Pieris*	2
Diervilla	1	*Laburnocytisus*	1	*Pinus*	152
Dryas	1	*Lamiastrum*	1	*Platanus*	1
Duchesnea	1	*Lamium*	3	*Pleioblastus*	3
Elaeagnus	1	*Larix*	11	*Podophyllum*	1
Elsholtzia	1	*Lathyrus*	1	*Polygonatum*	2
Empetrum	1	*Ledum*	3	*Polygonum*	4
Enkianthus	2	*Leucojum*	1	*Polystichum*	1
Ephedra	1	*Leucothoe*	1	*Poncirus*	1
Epimedium	7	*Ligularia*	2	*Populus*	82
Eranthis	1	*Ligustrum*	3	*Potentilla*	46
Erica	36	*Lilium*	9	*Primula*	2
Erigeron	1	*Liriodendron*	4	*Prunus*	33
Euonymus	21	*Lithospermum*	1	*Pseudolarix*	1
Eupatorium	1	*Lonicera*	54	*Pseudotsuga*	8
Exochorda	4	*Luzula*	6	*Pterocarya*	1
Fagus	50	*Lysichiton*	1	*Pterostyrax*	1
Festuca	5	*Lysimachia*	2	*Pulmonaria*	8
Forsythia	20	*Magnolia*	6	*Pyracantha*	4
Fraxinus	11	*Mahonia*	10	*Quercus*	23
Fuchsia	4	*Malus*	111	*Rhamnus*	3
Galanthus	1	*Matteuccia*	1	*Rheum*	1
Gaultheria	3	*Melica*	1	*Rhododendron*	700
Genista	7	*Menispermum*	1	*Rhodotypos*	1
Gentiana	1	*Metasequoia*	1	*Rhus*	1
Geranium	4	*Microbiota*	1	*Ribes*	12
Ginkgo	3	*Miscanthus*	6	*Robinia*	8
Gleditsia	5	*Molinia*	1	*Rodgersia*	6
Gymnocladus	1	*Morus*	1	*Rosa*	82
Hamamelis	7	*Muehlenbeckia*	1	*Rubus*	7
Hedera	23	*Muscari*	3	*Salix*	149
Helleborus	2	*Narcissus*	2	*Salvia*	1
Hepatica	1	*Neillia*	2	*Sambucus*	3
Hesperis	1	*Nothofagus*	1	*Sasa*	2
Hibiscus	1	*Omphalodes*	1	*Saxifraga*	1
Hippophae	1	*Onoclea*	1	*Schisandra*	2
Holodiscus	1	*Ornithogalum*	1	*Sedum*	1
Hosta	25	*Pachistima*	1	*Sesleria*	4
Houttuynia	1	*Pachysandra*	2	*Sinarundinaria*	1
Humulus	1	*Parrotia*	1	*Solidago*	1
Hydrangea	18	*Parrotiopsis*	1	*Sorbaria*	3

Genus	No. of taxons	Genus	No. of taxons	Genus	No. of taxons
Sorbaronia	1	*Taxus*	43	*Viburnum*	28
Sorbus	14	*Telekia*	1	*Vinca*	9
Spiraea	88	*Thalictrum*	2	*Vitis*	6
Staphylea	1	*Thuja*	62	*Waldsteinia*	2
Styrax	2	*Thujopsis*	2	*Weigela*	23
Sycoparrotia	1	*Tilia*	10	*Wisteria*	9
Stephanandra	3	*Trachelospermum*	1		
Symphoricarpos	6	*Trollius*	2		
Syringa	98	*Tsuga*	16		
Tamarix	1	*Ulmus*	10		
Tanacetum	1	*Uvularia*	1		
Taxodium	2	*Vaccinium*	4		