

Development and Structure of Wheat Collection in the Research Institute of Crop Production, Prague

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Abstract: Wheat genetic resources have been developed in the former Czechoslovakia since the beginning of the last century. Systematic gathering and evaluation of wheat collection started in the 1950s. The number of wheat accessions in the Czech Gene Bank is now 9969. Their passport data are available on-line at <http://genbank.vurv.cz/genetic/resources/>. The characterisation and evaluation data – results of at least two years' evaluation – are also accessible by request to the gene bank. The wheat collection is divided into two sub-collections – winter and spring forms. There are 31 species represented in the collection, including the two widely utilised species *T. aestivum* L. and *T. durum* Desf. *Triticum spelta* L. and *T. dicoccum* (Schränk) Schuebl are now grown by organic farmers. In 2001, the spelt wheat cultivar Rubiota was registered and recently, emmer Rudico was proposed for legal protection. The other *Triticum* species are used for breeding purposes as donors of valuable properties and characters. For instance, genes of resistance to powdery mildew were transferred into registered bread wheat cultivar Vlasta from *T. monococcum* L.

Keywords: wheat; genetic resources; history; evaluation; documentation; utilisation

History

Gathering, evaluation and utilisation of wheat genetic resources had a long tradition in the former Czechoslovakia and these activities continue in the two present countries, the Czech and Slovak Republics. The Czech wheat collection maintains bread wheat landraces and obsolete cultivars bred in the beginning of the last century. In addition, accessions of other wheat species such as *Triticum spelta* L., *T. dicoccum* (Schränk) Schubl and *T. monococcum* L. from the first decades of the last century have been preserved. The number of wheat accessions has increased continuously 9969 samples in the Czech Gene Bank. The accessions belong to 31 wheat species with most (8579 accessions) belonging to *T. aestivum* L. As the winter wheat cultivars are grown on more than 95% wheat of the growing area in the country, the winter forms dominate (59%) the wheat collection (Table 1).

Sources of new wheat accessions

Specialist from the Czech Gene Bank participate in collecting missions aimed at areas of wheat origin and domestication. Collected samples of wheat wild relatives, landraces and obsolete cultivars are multiplied and tested for their properties and characters. Possible donors of valuable traits are tested in more detail. In addition, some wheat accessions are obtained from mutual exchange of seed samples with other gene banks in the world. The exchange takes place on the principal of reciprocity. For this purpose and for all other cases when genetic resources are provided to users, a Material Transfer Agreement has been prepared.

Valuable lines with defined genes and gene complexes obtained as outputs of research projects form valuable part of the collection. Such material can be profitably used in breeding programs. In

Table 1 Number of wheat accessions in Czech plant genetic resources collection

| Species | Winter wheat | Spring wheat | Total |
|---|--------------|--------------|-------|
| <i>Triticum aestivum</i> L. | 5544 | 3035 | 8579 |
| <i>Triticum durum</i> DESF. | 95 | 784 | 879 |
| <i>Triticum dicoccum</i> (SCHRANK) SCHUEBL | 6 | 97 | 103 |
| <i>Triticum spelta</i> L. | 59 | 15 | 74 |
| <i>Triticum boeoticum</i> BOISS. | 45 | 2 | 47 |
| <i>Triticum araraticum</i> JAKUBZ. | 0 | 40 | 40 |
| <i>Triticum monococcum</i> L. | 27 | 26 | 53 |
| <i>Triticum turgidum</i> L. | 20 | 25 | 45 |
| <i>Triticum compactum</i> HOST | 18 | 26 | 44 |
| <i>Triticum dicoccoides</i> (KOERN. ex ASCH. et. GR.) | 18 | 8 | 26 |
| <i>Triticum polonicum</i> L. | 0 | 14 | 14 |
| <i>Triticum carthlicum</i> NEVSKI | 0 | 14 | 14 |
| <i>Triticum urartu</i> THUM. ex GANDIL. | 11 | 0 | 11 |
| <i>Triticum sphaerococcum</i> PERCIV. | 0 | 9 | 9 |
| <i>Triticum araraticum</i> JAKUBZ. | 4 | 0 | 4 |
| <i>Triticum macha</i> DEKAPR. et MENABDE | 3 | 0 | 3 |
| <i>Triticum karamyshevii</i> NEVSKI | 2 | 0 | 2 |
| <i>Triticum palmovae</i> G. IVANOV | 1 | 0 | 1 |
| <i>Triticum timopheevii</i> (ZHUK.) ZHUK. | 1 | 4 | 5 |
| <i>Triticum turanicum</i> JAKUBZ. | 1 | 2 | 3 |
| <i>Triticum vavilovii</i> (THUM.) JAKUBZ. | 1 | 0 | 1 |
| <i>Triticum zhukovskyi</i> MENABDE et ERITZJAN | 1 | 0 | 1 |
| <i>Triticum aethiopicum</i> JAKUBZ. | 0 | 2 | 2 |
| <i>Triticum sinskajae</i> A. FILAT. et KURK. | 0 | 1 | 1 |
| <i>Triticum ispahanicum</i> HESLOT | 0 | 1 | 1 |
| <i>Triticum militinae</i> ZHUK. et MIGUSCH. | 0 | 1 | 1 |
| <i>Triticum petropavlovskyi</i> UDACZ. et MIGUSCH. | 0 | 1 | 1 |
| <i>Triticum kiharae</i> DOROF. et MIGUSCH. | 0 | 1 | 1 |
| <i>Triticum miguschovae</i> ZHIR. | 0 | 1 | 1 |
| <i>Triticum timonovum</i> HESLOT et FERRARI | 0 | 1 | 1 |
| <i>Triticum flaksbergeri</i> NAVR. | 0 | 1 | 1 |
| <i>Triticum</i> sp. | 0 | 1 | 1 |
| Total | 5857 | 4112 | 9969 |

the case of advanced lines and cultivars obtained from breeding companies, breeders' rights are followed.

System of evaluation for *Triticum* species

Groups of characters. Each accession should be taxonomically identified. For that purpose morphological characters according to Descriptor List for Genus *Triticum* L. are evaluated. More precise identification of genotypes is achieved storage pro-

tein electrophoresis. This is the preferred method for wheat accessions of native origin and other valuable genetic resources. DNA fingerprinting is used to identify precisely accessions in the core collection.

Development and growth stages – emergence, heading, flowering, ripeness etc. – are recorded during vegetation and transferred into scoring scale system (1–9).

Also disease resistance is evaluated by scoring scale system. Leaf rust, gloom rust and stem rust

Table 2 Amount of *Triticum* sp. accessions evaluated

| | Number of accessions | Description data | % evaluated accessions |
|--------------|----------------------|------------------|------------------------|
| Spring wheat | 4112 | 3719 | 90.4 |
| Winter wheat | 5857 | 4230 | 72.2 |
| Total | 9969 | 7949 | 79.7 |

are tested under high infection pressure. On the other hand, spontaneous occurrence of powdery mildew is recorded.

Post harvest analyses of yield components – number of spikes per area unit, number of kernels per spike, TKW etc. – characterise the most important traits and their influence on yield potential.

Grain quality parameters, such as crude protein content, gluten content, gluten index, sedimentation value, falling number etc., are determined in the laboratory by classical methods or by NIR technique.

System of evaluation. Each accession is evaluated for at least 2 years. To compare results from different years (different growing conditions), check cultivars are used for long period and replaced step by step.

Preparation of data for documentation system. Passport data are assembled from accession donor, literature, other wheat databases etc. They are recorded in the central database under a unique accession number.

The averaged results of field and laboratory evaluations are converted into scoring scale system for each character in accordance to Wheat Descriptor List. At present the evaluation data have been obtained for 79.7% of accessions (Table 2).

Wheat genetic resources documentation

Accessions of all species of the genus *Triticum* L. gathered in Czech wheat collections are documented in central database of genetic resources in the Czech Republic, EVIGEZ, which is available at <http://genbank.vurv.cz/genetic/resources/>. Czech wheat passport data are included in ECP/GR Euro-

pean Wheat Database (EWDB) located on the RICP's server <http://genbank.vurv.cz/ewdb/>. In close cooperation with Dr. Martynov from VIR St. Petersburg the database Pedigree and Identified Alleles of Genes has been prepared and regularly completed <http://genbank.vurv.cz/wheat/pedigree/>.

Utilisation of wheat genetic resources in breeding, research and agricultural practice

Bread wheat (*Triticum aestivum*.) accessions are frequently requested by breeders for their breeding programs (e.g. in 2004, 810 seed samples were provided to different users in the country and in abroad)

Spelt wheat (*T. spelta*.) is grown in the Czech Republic primarily by organic farmers. For that purpose suitable winter genotype was selected from wheat collection and registered as Rubiota cultivar in 2001. Rubiota is characterized by having TKW over 60 g and a crude protein content that is 1.5–2% higher than in Franckenkorn, the other registered cultivar.

Emmer (*T. dicoccum*) is of increasing importance particularly for organic farming. In 2004 a genotype with high disease resistance, very good yield level and stability was selected from the collection. The RICP applied for legal protection of the selected material under the proposed name Rudico

Einkorn (*T. monococcum*) genotypes are tested in field experiment for their possible use in practice or as a donors of valuable properties and traits. In the past, the high resistance of *T. monococcum* to powdery mildew was utilised in breeding the registered bread wheat cultivar Vlasta.