



The Barley Collection Of Plant Gene Resources Of Canada - A World-Class Resource

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Introduction

The mandate for Plant Gene Resources of Canada (PGRC) is the preservation of the genetic diversity of crop plants, their wild relatives, and native species important to Canadian agriculture and biodiversity. Over 110,000 seed samples of more than 965 plant species and 241 genera are preserved in the seed bank in Saskatoon, Saskatchewan, and approximately 3,500 accessions are established at the Canadian Clonal Genebank in Harrow, Ontario. PGRC's collection includes principal world base collections of barley and oat and duplicate world base collections of pearl millet and oilseed crucifers. Gene banks serve as reservoirs of genes potentially useful for a wide variety of purposes including resistance to diseases and pests and other environmental stresses, as well as for traits that increase yield or food quality. Often, however, awareness of the value and utilization of gene bank resources is somewhat limited.

Origins

PGRC's barley collection was initiated in Ottawa in the 1970's and initially consisted of about 3,000 accessions of old Canadian barley cultivars and breeding material. During the 1980's, the collection grew to about 13,000 accessions with the addition of various breeding collections and accessions comprised of landraces and wild genotypes. A duplication of the USDA collection was added in 1989, increasing the size of the collection to 36,000 accessions. Continued minor acquisition during the 1990's increased the size of the collection to 37,500 accessions. In 1998, the collection was moved to Agriculture and Agri-Food Canada's Saskatoon Research Centre. Over the last few years, the collection has grown to about 39,900 accessions with the addition of landrace accessions of *Hordeum vulgare* subsp. *vulgare* L., and *H. vulgare* subsp. *spontaneum* (C. Koch) Thell., originating in China and Ethiopia.

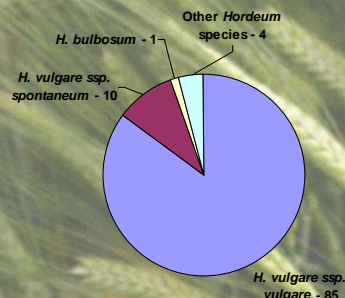
Composition

At present, PGRC's barley collection comprises 28 *Hordeum* species collected from over 100 countries. The collection contains approximately 4,200 cultivars and 14,000 landrace accessions. The collection is the largest *Hordeum* collection world-wide, with approximately 12% of the world's accessions, and is the third largest collection of *H. vulgare* subsp. *spontaneum* (15% of the world's accessions) (von Bothmer et al. 2003). PGRC's collection of wild species of *Hordeum*, excluding *H. vulgare* subsp. *spontaneum*, comprises 2,100 seed accessions of 37 taxa collected from about 100 countries. 57% of the world's accessions of *H. bulbosum* L., and 41% of the world's accessions of the other wild species of *Hordeum* are maintained at PGRC (von Bothmer et al. 2003). The composition of PGRC's barley collection, defined in terms of species and countries of origin, is illustrated in the two adjacent figures.

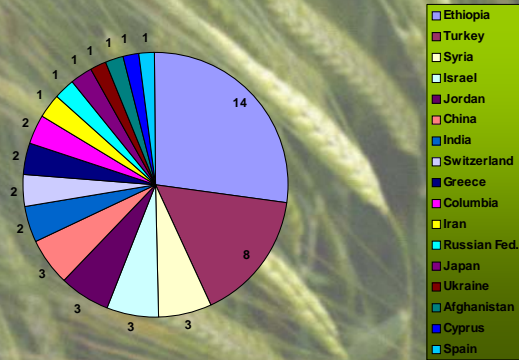
Management

PGRC's barley collection is managed in accordance with international standards for gene banks. Seed is stored in sealed foil bags at -20°C. Regeneration of selected accessions is undertaken each year. Since 1999, about 11,000 barley accessions have been regenerated. Characterization and evaluation of accessions are important aspects of gene bank operations, but resources available for these activities are limited. Basic agro-morphological characterization is done on the accessions being regenerated, and includes 22 descriptors such as # spikelets/rachis node and lemma colour. Evaluation for phytochemical content and disease resistance is dependent on collaboration with other institutions. Phytochemical evaluation has been done for a variety of characters including protein, oil and beta-glucan content. Approximately 6,100 accessions have been evaluated for beta-glucan content, with 127 accessions having a beta-glucan content of greater than 6.6%. Screening for disease resistance has been done on a proportion of the USDA-derived accessions of PGRC's collection, with 604 of 10,333 accessions rated resistant to net blotch, 63 of 749 accessions rated resistant to leaf scald, and 63 of 13,544 accessions rated resistant to spot blotch. Screening for resistance to Fusarium Head Blight (FHB) has been done at AAFC's Brandon Nursery. Of the accessions screened for FHB, 81 of 1673 were rated resistant. Countries of origin for accessions resistant to FHB included Afghanistan, China, Ethiopia, Germany, Mexico, Sweden, Turkey, UK, and Uzbekistan, indicating the importance of the ecogeographic variation in PGRC's barley collection. Documentation of accession information is available in PGRC's database, GRIN-CA (http://pgrc3.agr.gc.ca/index_e.html). Part of PGRC's responsibility is the free and unrestricted exchange of germplasm with all nations, which permits access to the collection by any person with a valid use (most frequently plant breeders and other plant biologists). About 1,100 barley accessions have been distributed per year from 2001 to 2005, primarily within Canada, but also to Australia, China, Germany, Korea, USA, and other countries.

PGRC's Barley Collection - % Composition By Species



PGRC's Barley Collection - % Composition By Top 15 Countries of Origin For *Hordeum vulgare* (excluding Canada & USA)



Potential For Utilization

The 39,900 genotypes in PGRC's barley collection are of diverse taxonomic and ecogeographic origin. Consequently, accessions from the collection have the potential to be utilized in diverse research projects oriented to cytogenetic, molecular and phylogenetic studies, environmental adaptation, and phytochemical and agronomic studies. Also, there exists the long-term value of specific genes for disease resistance and other characteristics of potential importance. It is possible that PGRC's barley collection is reasonably representative of the existing gene pool of *Hordeum*. Consequently, if comprehensively characterized and evaluated, the collection could provide a very good indication of the range of variability for a diversity of traits in cultivated barley, which is important to know in order to define plants with novel traits.

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Literature Cited

von Bothmer, R., T. van Hintum, H. Knüpfper, and K. Sato (eds). 2003. Diversity in Barley (*Hordeum vulgare*). Elsevier. Amsterdam.