Electronic access to the conserved plant diversity of Bulgaria

Nikolaya V. Velcheva

Agricultural Academy, Konstantin Malkov Institute of Plant Genetic Resources , 2 Drouzhba Str., 4122 Sadovo, Plovdiv district, Bulgaria;
e-mail: nikolaya_velcheva@abv.bg

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Abstract. Plant diversity is a public resource with benefits to the entire society. In this context, information is the core of ensuring comprehensive approach and interaction among all stakeholders. During the period 1982–2019, the fund of the National Genebank in IPGR Sadovo has been enriched with 52 275 seed accessions. PHYTO'2000 documentation system optimizes the management of plant genetic resources in terms of their targeted storage, study, reproduction, free exchange, and use. During expeditions, 9929 accessions have been collected, including local varieties and populations from home gardens and small farms, as well as wild forms from their natural habitats. There are 36 451 genotypes introduced from abroad by international free exchange. Registered are 5895 breeding materials: lines and advanced varieties. Collections have been created of cereals, grain legumes, technical and fodder crops, vegetables, medicinal and aromatic plants. All seed accessions are listed, according to the international standards of FAO/Bioversity Multi-Crop Passport Descriptors. Passport data includes taxonomic descriptions, biological status and origin of the accessions. The existing European collaboration within ECPGR contributes to better coordination between the genebanks and users of conserved germplasm. The European Search Catalogue for Plant Genetic Resources, EURISCO, provides free access to the stored *ex situ* collections in Europe.

Key words: documentation, EURISCO, *ex situ* conservation, plant genetic resources

Introduction

Bulgaria is one of the richest countries in plant diversity in Europe. In spite of its small size (110 910 km^2), its territory comprises three biogeographical regions: Alpine, Black Sea and Continental. Diverse relief and geology, specific microclimatic conditions and millennium-strong human activity determine the abundant plant diversity and habitats, most of them with conservation status (CBD 2014).

Food security of the people depends largely on the species variety supply of clean and healthy foods, as well as on the ability to react to climatic changes. Plant genetic resources (PGR) comprise a huge diversity of the cultural and wild flora, local populations and forms, old traditional and improved varieties (ITPGRFA 2009).

Sustainable conservation and use of plant diversity is one of the global priorities at international level. Plant diversity preservation for future generations is a fundamental part of the Second Global Plan of Action of The Food and Agriculture Organization (FAO 2012). PGR play a significant role in the development of sustainable agricultural systems, in ensuring food security of the population, production of high-quality foodstuffs, including bio-production, and guaranteeing the economic development and innovations (FAO 1992, 2008, 2014).

Plant diversity is a public resource, which should profit the entire society. Therefore, all information activities are directed towards guaranteeing a holistic approach and interaction between all stakeholders (CBD 2011).

The main goal of all EU programs regarding plant diversity is to improve the coordination of conservation activities in Europe and to facilitate the access to PGR and the information about them. The Institute of Plant Genetic Resources (IPGR), Sadovo, Bulgaria, is the National Coordinator of the European Program for Plant Genetic Resources (ECPGR). The scientific areas are coordinated in line with the EU priorities in agriculture and rural development.

The aim of this study is to present the process of documentation of the PGR genebank collections and efficiency of free access to the conserved plant diversity of Bulgaria, according to international standards.

Material and methods

The IPGR Information Centre was established in 1982. It is responsible for registration, documentation and information about the seed accessions conserved in the National Genebank of Bulgaria.

IPGR maintains an electronic register PHYTO'2000 in Microsoft Access 2003 format. Seed accessions are listed according to the international standards of FAO/Bioversity Multi-Crop Passport Descriptors (2017). Each genotype has a unique collection number and passport characterization data to be managed at its level of conservation: base collection (long-term storage at –18 °C), working or exchange collection (medium-term storage at +6 °C), *in vitro*, and *in vivo* collection.

A free electronic access to information about the Bulgarian PGR collection is possible through the international databases. The National Genebank in Sadovo was nominated by ECPGR as a focal point for Bulgaria in EURISCO – a search catalogue providing information about *ex situ* plant collections maintained in Europe (Weise & al. 2017).

Free exchange of seeds for scientific purposes in the country and abroad is based on signing a Standard Material Transfer Agreement (SMTA), according to the international genebank standards (FAO 2014).

Results

The established *ex situ* collections by plant groups of the National Genebank comprise over 60 000 seed accessions (https://www.ecpgr.cgiar.org/resources/germplasm-databases/eurisco-catalogue).

During the period 1982–2019, the fund has been enriched with 52 275 accessions, divided into 122 botanical families and including 3563 taxonomic descriptions.

PHYTO'2000 documentation system optimizes the management of plant genetic resources in relation to their targeted storage, study, reproduction, free exchange, and use. All accessions are recorded by 33 descriptors: catalogue number, taxonomic description, biological status of the genotype, donor, and geographical origin.

Currently, the accessions of local Bulgarian origin constitute 30 % of the genebank fund, their conservation and sustainable preservation being a priority in the activities of enrichment of the collections, in accordance with the latest national-level emphases. Accessions from the collecting missions amount to 9929 local varieties and populations from home gardens and crop wild relatives from their natural habitats. A higher percentage in the local accessions claim the grain legumes and vegetable crops, followed by cereals. Genetic diversity is discernible even in a single farm and village. Emerging from unconscious selection within a population and well-adapted to environmental factors, local PGR are very important in the context of limited use of fertilizers and plant protection products in organic farming. Local varieties could be successfully used in crop breeding, in order to transfer such valuable economic traits as tolerance to abiotic and biotic stress, high biological value, etc. The described geographical characteristics of the collected accessions make possible restoration of the traditional varieties in their regions of origin by means of the seed resources stored in the *ex situ* collections in the genebank.

In the database, 5895 breeding materials are registered: lines and improved new varieties from the institutes of the Agricultural Academy, Bulgarian Academy of Science, Agricultural University, etc. The access to these materials is regulated in accordance with the principles of protection of the breeders' intellectual property rights.

There are 36 451 genotypes introduced from abroad by the international germplasm free exchange. The National Genebank maintains professional contacts with about 194 genebanks, PGR centres and botanical gardens worldwide. The main

partners of IRGR Sadovo in the exchange are such established research centers as GRIN (USA), ICARDA (Syria), VIR (Russia), NordGen (Sweden), IPK (Germany), INRA (France), and John Innes Center (UK). The requested foreign germplasm undergoes investigation under the country's environmental conditions, and is used as donor of valuable traits in the breeding programs.

Ex situ collections are maintained of cereals, grain legumes, technical, fodder, vegetable, medical, and aromatic crops. Curators collect characterization and evaluation data from the conducted experiments, according to the international descriptors of the PGR accessions, in terms of sustainable use of the conserved plant diversity.

The study shows the main information flows in management and use of the conserved plant diversity in Bulgaria (Fig. 1).

IPGR Sadovo maintains the richest PGR genebank collection in Southeast Europe. According to EURISCO (data check November 2019), the BGR National Inventory comprises 69 336 accessions based on FAO descriptors (http://eurisco.ecpgr.org). The collection consists of genotypes of diverse geographical origin supplied by three Bulgarian institutes (Table 1).

The Bulgarian collection is the seventh biggest in Europe and claims a share of 3.5 %, after Great Britain, Russia, Germany, Ukraine, Spain, and Poland.

Information includes taxonomic description, registration data, country of origin, donor, ecological and geographical characterization of the habitat, biological status, type of conservation (long term, medium or

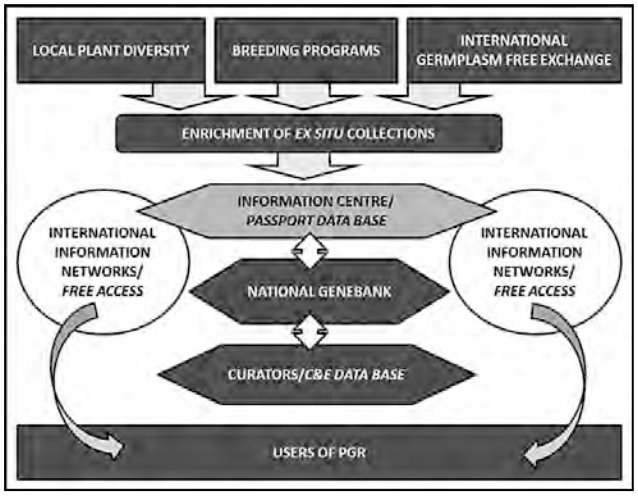

Fig. 1. Information networks supporting the PGR management and use.

Table 1. Status of the Bulgarian PGR collections in EURISCO.

FAO INSTCODE	Institute	Total number of accessions	With BGR origin
BGR001	IPGR Sadovo	64 916	15 990
BGR005	IREMC Kazanlak	565	4
BGR029	DAI Gen. Toshevo	3 857	1 829
Total number of accessions		69 336	17 823

work collection, whether the genotype is available for exchange, whether it is duplicated in other genebank, etc.). Taxonomic description of crops follows the nomenclature of the USDA Genetic Resources Information Network (GRIN). In terms of their taxonomic composition, the preserved accessions belong to 532 genera and 1927 plant species. The highest share of the accessions goes to the genera *Triticum, Hordeum, Zea, Phaseolus, Avena, Pisum, Capsicum, Linum,* and *Arachis*.

The Bulgarian PGR collection consists of accessions of different biological status divided into different categories: crop wild relatives, traditional and advanced varieties, with a high share of breeding materials presented in their various subcategories (lines, synthetic populations, hybrids, etc.). Within EURISCO, in addition to the PGR electronic catalogue, there are also other databases: AEGIS (A European Genebank Integrated System) and ECPGR Central Crop Databases (ECCDB). The status of the Bulgarian collection in AEGIS includes information about 341 unique accessions of Bulgarian origin of six plant species (http://aegis.cgiar.org). A new EVA (European Evaluation Network) electronic system is currently under construction to improve the access to and use of the stored PGR collections, including evaluation and characterization information. All these databases use the EURISCO format (FAO/Bioversity, 2017).

Beneficiaries of the PGR information are all stakeholders at regional, national and international level: scientists, breeders, farmers (including bio-producers), NGOs, environmental organizations, students in the field of agricultural sciences, etc.

Discussion

Presently, one of the greatest challenges to humanity is to ensure food security for humans and to preserve nature. An important step in this direction is increased productivity of crops under reduced in-

vestment conditions, while ensuring along with this sustainable development and conservation of the natural resources. In relation to the global trends in biodiversity conservation and life in a healthy environment, in recent years, the collecting missions have been focused on local traditional varieties and crop wild relatives with valuable genes for the breeding process, organic production and sustainable agriculture.

The signing of the International Treaty for PGR (ITPGRFA 2009) and Nagoya Protocol (CBD 2011) regulates a free access to PGR of the scientific, public, ecological and other organizations, for fair and equitable distribution of the benefits arising from their use.

According to FAO WIEWS (World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture), 1750 genebanks and more than 2500 botanical gardens work actively now in the world. They are responsible for conservation of more than 7.4 million PGR accessions (http://www.fao.org/wiews/data/ex-situ-sdg-251/overview/en/). *Ex situ* collections are the backup copy of plant diversity and thus the preservation of plants is guaranteed. The National Genebank of Bulgaria possesses one of the richest PGR collections in Europe. Conservation and targeted use of PGR is a national responsibility and priority, the successful implementation of which depends directly on the good coordination among all partners and stakeholders: storage and documentation specialists, curators of collections, breeders, scientists, farmers, NGOs, politicians, etc.

At international level, EU plays an active role in ensuring the achievement of global appointments for biodiversity and PGR conservation. In relation to the access to plant diversity, transfer of data about Bulgarian *ex situ* collections to international networks require highly specialized information from all users of PGR in order to ensure guaranteed and equitable access. One of the priorities of ECPGR is creation of equal mechanisms in the databases construction in connection with the inclusion of national collections.

Conclusions

The Bulgarian National Genebank in IPGR Sadovo maintains one of the largest PGR collections in Europe, with the richest conserved plant diversity in Southeast Europe.

In line with the international standards of FAO/Bioversity, the documentation system optimizes management of the plant genetic resources in relation to their sustainable conservation and target use.

European Information Networks provide free access of potential users to conserved genotypes, according to the principles of the International Treaty on Plant Genetic Resources for Food and Agriculture and implementation of the Nagoya Protocol on equitable distribution of their benefits.

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