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DIVERSITY OF COLLECTED LOCAL VARIETIES IN BULGARIA ASSESSED BY USING THE NATIONAL ELECTRONIC REGISTER OF PLANT GENETIC RESOURCES DATA

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Abstract

Before the globalization the local communities relied on the available traditional food plants for their nutritional and health-related needs. They remain neglected despite their huge biological value and potential. Recent literature reports that local food systems are more resilient, sustainable, and adaptive during times of climate changes, pandemics, and conflicts. It is important to follow research strategies to support their preservation and more widespread use in future. Significant plant gene fund and knowledge has been gained through conducted expeditions in Bulgaria. In this paper, the status of collected local diversity in Bulgarian genebank is explored based on documentation of accessions and the focus is on the needs of future development. The ex situ collection has been enriched with 10,883 local accessions from cereals, vegetables, pulses, medicinal and aromatic plants. Collected materials are listed in the electronic register according to descriptor of FAO/Bioversity. The results from inventory show that the country is rich in genetic biodiversity of vegetable crops and pulses, which requires community support initiatives to preserve them also in situ/on farm.

Key words*: plant genetic resources, collecting missions, data base, EURISCO.*

INTRODUCTION

Before the globalization and the intensification of agriculture production the local communities relied on the available traditional food plants for their nutritional and health-related needs. Nowadays they remain largely neglected despite their huge biological value and potential (Ivanova et al., 2021; Khoury et al., 2022).

Home gardens contribute to the conservation of biodiversity at the ecosystem, species and within species levels. They provide complex, multi-layered environments in which farmers can maintain large numbers of useful plant species managed in a sustainable manner over decades or even centuries. They may also provide a basis for the maintenance *in situ/on farm* of significant amounts of intra-specific genetic diversity of useful plant species (Antofie et al., 2020; Galluzzi et al., 2010; Raggi et al., 2022).

Recent literature reports that local food systems are more resilient, sustainable, and adaptive especially during times of climate changes, pandemics, and conflicts. Since traditional local varieties offer some special benefits over the commercial cultivars, it is important to follow research strategies to support their preservation and more widespread use in future (Bratu et al., 2022; Raggi et al., 2021; Stoilova et al., 2014).

Bulgaria is characterized by one of the richest countries with plant diversity in the Balkans. Significant plant gene fund and knowledge has been gained through conducted expeditions and basic research on the diversity and availability of local varieties in various regions (Krasteva et al., 2009; Knupffer, 2016; Simeonovska et al., 2013).

Collection of locally adapted traditional crop varieties is carried out by implementing the National Program for Conservation and Management of Plant Genetic Resources with the focus on their sustainable preservation and use, according to Plant Genetic Resources Strategy for Europe (ECPGR, 2021).

The main activities are: (1) Organizing expeditions in rural areas to collect samples from plant genetic resources of agricultural crops and wild crop relatives; (2) Compiling passport data and supplement genebank collections; (3) Sustainable conservation; (4) Phenotypic and genotypic characterization; (5)

Making the plant genetic resources available for exchange in accordance with the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2009) and Nagoya Protocol (CBD, 2011); (6) Expanding the use of local agrobiodiversity – cooperation with research institutions, international collaboration, return the local and traditional varieties to hobby gardeners, promoting exhibitions, publications, media coverage, etc.

The aim of the study is to explore the status of collected local diversity in Bulgaria based on genebank documentation and to determine the needs of future development of collecting activities in rural areas.

MATERIALS AND METHODS

Plant genetic diversity of Bulgaria is maintained in 16 research institutes and 13 experimental stations at the Agricultural Academy, part from the Ministry of Agriculture. A total number of over 160,000 plant forms are maintained in various collections - over 100,000 field crops, over 5,000 vegetable crops, over 40,000 perennials and over 130 essential oil crops.

The Center for information and documentation of plant genetic resources at IPGR-Sadovo has been established in 1982 and completely renovated in 2021 under a project BG PLANTNET, financed by Bulgarian National Science Fund. It works according to the international documentation standard of FAO/Bioversity (2017).

The National genebank of Bulgaria, situated at IPGR-Sadovo, was built in 1984 and carries out a scientific program for the long-term preservation of germplasm with seeds under controlled conditions in accordance with the standards developed by FAO (2016).

The electronic register contains the following passport information: taxonomy, catalogue number of accessions, acquisition date, country of origin, donor of the sample, collection site, ecology-geographical data, biological status, type of storage: base collection (long-term), exchange collection (medium-term), work collection (short-term), *in vitro* and/or field collection, botanical garden, etc.

The register tools are useful for searching the areas of germplasm distribution, for monitoring, for deciding potential priority areas for conducting future collection missions.

The collecting mission activities were conducted under the methodology of Guarino et al. (2011) and in accordance with the ECPGR (2017) concept for *on farm* conservation of plant genetic resources for food and agriculture.

Surveys and interviews with the small local farmers were carried out. The generalized and systematized information on the traditional knowledge and good practices is available.

The data is published with free access in the European search catalogue for plant genetic resources EURISCO (http:eurisco.ecpgr.org).

RESULTS AND DISCUSSIONS

In Bulgaria, as in many countries, the losing of genetic resources of crops is increasing. Future progress in crop improvement and food security depends on immediate conservation of the plant genetic resources and their effective utilization by crop breeders. In this context, a great deal has been accomplished by IPGR-Sadovo in the last 15 years to safeguard the plant genetic resources which constitutes the natural heritage. However, much still remains to be done in improving the conservation strategies and upgrading the *ex situ* collections, which include a wide range of diversity (primitive varieties, landraces, weedy forms, and wild relatives).

The ecology-geographical conditions of Bulgaria have been a prerequisite for the establishment of a wide variety of plants that are used for commercial and non-commercial purposes. The seeds are usually inherited within the families, or received from neighbors from the same village or adjacent locations. Some types of local vegetables (tomatoes, peppers, watermelons, melons, onions, garlic, etc.) that are still grown have an increasing limited presence. Very often commercial varieties and hybrids are used in home gardens, but still some varieties exist which have passed from hand to hand or were populations, selected by traits.

The autochthonous economic valuable species (*Triticum durum*, *Triticum aestivum*, *Secale*

cereale, *Avena sativa*, *Hordeum vulgare*, *Sorghum*, *Zea mays*, *Solanum lycopersicum*, *Capsicum annuum*, *Allium cepa*, *Brassica oleracea*, *Cucumis sativus*), horticultural and field, cereals and fodder, annual and perennial legumes and more than 250 species of traditional medicinal plants provide products for local consumption and domestic trade.

Currently, accessions with local origin comprise 23% of the *ex situ* collections, conserved at the gene bank in IPGR-Sadovo as the main priority. The accessions acquisitioned by expeditions are 10,883 - species and varietal diversity of landraces, including local varieties from home gardens and crop wild relatives from their natural habitats. According to the documentation the diversity of local varieties in Bulgaria is shown on Figure 1.

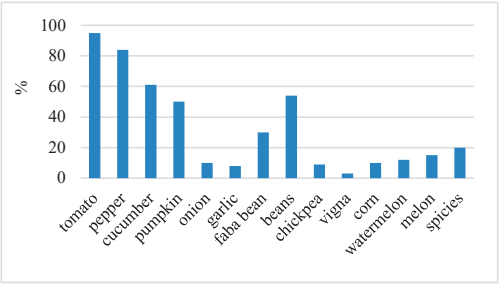

Figure 1. Diversity of local crops in Bulgaria

During the period 1982-2022 expeditions for collecting local varieties were organized in various regions of the country, funded by national and international projects. The routes of the collecting missions were determined on the basis of prior awareness of the specifics of the respective production areas or local habitats.

Villages, sufficiently distant and with different ecological and geographical characteristics were marked.

The priorities of collecting missions are: to collect variability in a particular crop or crop group; to collect tolerant forms to biotic and abiotic stress; to collect crop wild relatives, weedy types and related taxa of agricultural relevance in accordance with the reported strategies from Raggi et al. (2021, 2022).

Collected local accessions of cereals, grain legumes, vegetables and medicinal crops are a significant resource as a source material for crop breeding and for the utilization of their biological potential for healthy nutrition. These genotypes, formed as a result of the natural or artificial selection in population from farmers and adapted to a special regions in the country, get used very well to the unfavorable agri-environmental conditions.

The number of local cereal landraces and old varieties from durum wheat (118), common winter wheat (736), einkorn (67), oat (17), rye (42) and corn (250) were collected.

Grain legumes are a major contributor to global food production worldwide and are a major source of protein. They occupy about 15% of the local accessions, stored in the gene bank, represented by 45 species and the following main crops: chickpea (52), common vetch (40), latyrus (222), lupin (17), pea (29), originating from Sofia, Plovdiv, Stara Zagora, Strandzha and General Toshevo regions. The bean (2185) accessions are collected from the villages arround Smolyan, Velingrad, Kazanlak, Haskovo, Dimitrovgrad and Svilengrad.

Traditional vegetable varieties of tomato (533), pepper (1826), eggplant (56), onion crops (547), cabbages (91) and leafy vegetables (106) and spices.

The Cucurbits have been grown from thousands of years in our lands. They are of great economic importance in our country and worldwide. The fruits and seeds are used for consumption, medical purposes, as forage, as well as for decoration. The group includes *C. maxima* (65), *C. moschata* (40) and *C. pepo* (290), collected from Plovdiv and Harmanli regions.

Landraces of medicinal and aromatic plants, used in bio and home gardens for medicinal purposes, herbal teas or decoration, were collected.

The inventory of the conserved gene fund identifies areas in the country with a concentration of local varieties, where collecting missions are urgently needed to prevent the loss of valuable for crop breeding and agricultural practice diversity (Table 1).

Table 1. Localities and collected local varieties in Bulgaria during the period 1982-2022

Main crop groups	Explored regions in Bulgaria	Numb. of accessions
Cereals	Regions with extensive agriculture, including mountainous and semi-mountainous – South-East and South-West parts of the country, closed border regions, monastery lands, etc.	1,827
Grain legumes	The regions of Blagoevgrad, Kyustendil, Strandzha-Sakar, Rodopi Mountains, Ludogorie, etc.	3,099
Vegetables	Home garden regions near Gorna Oryahovitsa, Veliko Tarnovo, Svishtov, Vidin, Plovdiv, Pazardzhik, Haskovo, Dimitrovgrad, Popovo, Petrich, Sandanski, etc.	4,821
Cucurbits	Home garden regions near Pleven, Vidin, Razgrad, Shumen, Yambol, Lyubimets, Svilengrad, Ivailovgrad.	686
Medicinal and aromatic	Home gardens, monastery lands, mountainous and semi-mountainous regions.	450
Total number of collected local accessions		10,883

Ethnobotanic data related to the cultivation, utilization and genetic erosion process is recorded as done by Khoury et al. (2022).

The purposes of the development of collecting activities in rural areas are: (1) to make the traditional plant diversity available for use by current and future generations; (2) to improve the biological and economicaly important traits in crop varieties through plant breeding processes; (3) to meet the needs of farmers rural and eco communities; (4) for research activities; and (5) to restore diversity lost *in situ/on farm* and natural habitats.

These goals could be achieved through sustainable protection of traditionally grown local varieties; active participation of all stakeholders, especially inclusion of students in this process; development of target projects and establishment of a network of partners and united teams; searching for opportunities to restore the traditional varieties in districts where there is an interest using the hystorical data.

Home gardens should be considered as a model for sustainable agro-food systems, integrating both economic and ecological advantages. Some of local farmers already sell the production of vegetables and beans, as well as their products for supply guesthouses and tourist resorts with added value.

CONCLUSIONS

In the period 1982-2022 the Bulgarian genebank was enriched with rich diversity of 10,883 local varieties from cereals, grain legumes, vegetables, cucurbits, medicinal and aromatic plants.

Collected materials are listed in the National register of plant genetic resources, according to the descriptor of FAO/Bioversity and are available in EURISCO.

Genebank documentation plays significant role for conservation activities, and allows effective use of germplasm. The National register enable rapid dissemination of information to users as well as assist curators to manage the collections more efficiently.

Based on information for agro-ecological origin the distribution of local varieties from the main crop groups in Bulgaria are determined. The country is rich in genetic biodiversity of vegetables and grain legumes, which requires community support initiatives to preserve them *in situ*/*on farm*, through the distribution of knowledge, publicity and cooperation.

The Bulgarian home gardens can be defined as a microsystem with a high degree of diversity of plant species: vegetable crops, grain legumes, medicinal and aromatic plants, etc. still grown in different combinations in various parts of the country.

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