ECOLOGIA BALKANICA

2026, Vol. 18, Issue 1 June 2026 pp. 133-139

The role of local varieties in the context of biodiversity conservation

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Abstract. In the last few decades, a huge number of old and traditional varieties have been replaced by new commercial varieties. Under these circumstances, an approach for biodiversity conservation by using two strategies: in situ/on-farm and ex-situ preservation, represents a research priority. International collaboration between genebanks has become crucial in ensuring the global conservation and sustainable use of genetic resources in the framework of maintaining compatibility and interoperability in the European area. The Green Deal promotes ecological practices that have a positive impact on the protection of biological resources and support agricultural systems in climate change. The purpose of the study is to improve documentation and visibility in the national genebanks of Bulgaria and Slovakia due qualitatively exchange of experience and establishing a joint research plan based on their long-standing mission of storage and use of plant diversity. By expeditions for local accessions in the rural areas and international germplasm exchange using the Standard Material Transfer Agreement, the diversity of the National collections is increased, following the priorities of the EU Biodiversity Strategy 2030. The results of the project help valorisation of plant gene pool through open access to ex situ collections databases for promoting the role of local varieties in biodiversity conservation and meeting the farmers' needs. The Bulgarian and Slovakian genebank collections are documented by FAO/Bioversity descriptors and published in the European catalogue EURISCO (http://eurisco.ecpgr.org). They are presented with a valuable amount of seed duplicates in the Svalbard Global Seed Vault. The research is based on the cooperation project DIGIVALPGR.

Key words: crop genebank, collection mission, germplasm exchange, passport database, information system, climate change.

Introduction

Plant diversity is essential for food security, sustainable agriculture, and environmental protection. Almost all the relevant documents on the genetic resources, adopted by international bodies, underline the need for crop conservation, not only for this generation, but most of all, for the future of humanity, and guarantee open access to its diversity. The European Cooperative Programme for Plant Genetic Resources (ECPGR) is a supportive initiative aiming at the coordination of all genebank activities, such as conservation, characterization, documentation, and exploitation of collections. In addition, the European members have developed national strategies that exploit their local crop diversity, an important source of genetic traits for breeding programs, which are of high economic (traditional products, agritourism) and environmental importance (Fideghelli & Engel, 2008).

In the last few decades, more and more old and traditional landraces have been replaced by new and modern varieties. Local varieties have historical origins, are genetically diverse, adapted

to the region, associated with the native agricultural system, and are the dynamic population – very important as gene pools for breeding programs and providing sustainability of food security, with response to the current and future impacts of climate change (Demirboğa et al., 2024). Under these circumstances, a holistic approach for biodiversity conservation by using elements of two strategies: in situ/on-farm and ex situ preservation, represents a research priority. Reintroduction of genebank accessions, with potential by a set of criteria (regionality, traditional taste, usability, status of conservation), in home gardens allows their further adaptation and diversification (Arndorfer et al., 2009). Valorization encompasses the process by which local varieties become a symbol, playing an important role in community identity. Access to passport information for ex-situ collections is the basis for the possibility of their return to the agri-food chain in the region of their origin.

The modern ethnobotany is focused on the exploration of local natural, semi-natural, and wild diversity and documentation of traditional knowledge as a base data for its protection (Dragoeva et al., 2021). Specific information about the distribution of the medicinal plants in the areas of the Strandzha Mountain and the Southern Black Sea Coast in Bulgaria, as part of their sustainable preservation, is conducted by Todorov et al. (2025). A rich genetic diversity of medicinal and aromatic plants, collected from different regions of Slovakia and the Czech Republic, is reported in the study of Čičová & Fialová (2019). It has been found that local *Phaseolus* varieties, collected from four mountain locations of Bulgaria, perform high adaptability to the local conditions and to climatic changes (Stoilova et al., 2014).

International collaboration between genebanks has become crucial in ensuring the global conservation and sustainable use of genetic resources in the framework of maintaining compatibility and interoperability in the European area. The Green Deal promotes ecological practices in connection with climate change and sustainability that have a positive impact on the protection of biological resources (Boix-Fayos & De Vente, 2023).

The purpose of the study is to improve digitalization and visibility in the national genebanks of Bulgaria and Slovakia due qualitatively exchange of experience and establishing a joint research plan based on their long-standing mission of storage and use of plant diversity. The hypothesis is that it helps valorization through better access to local varieties as a part of biodiversity for meeting the climate challenges and farmers' needs.

Materials and methods

Conservation and sustainable preservation of the plant biodiversity from wild and cultivated flora is the main priority of the IPGR-Sadovo and RIPP-Piešťany as partners in ECPGR and Bioversity International.

During the period 2024-2025, different joint activities, such as seminars, technical visits to both genebanks and facilities, germplasm exchange, and expeditions in Slovakia and Bulgaria, were carried out by the collaborative research project DIGIVALPGR.

Seven expeditions for surveying and inventorying different areas in Bulgaria according to the EU Biodiversity Strategy 2030 were carried out (Hermoso et al., 2022). A system for latitude, longitude, and altitude of the collecting site was used. Ethnobotanic data and other information of interest regarding aspects related to the cultivation and utilization of landraces were recorded.

A questionnaire for collecting data during collecting missions via interviewing local farmers was created and implemented in both countries.

According to the international documentation standard Multi-Crop Passport Descriptor (FAO/Bioversity, 2017) the electronic catalogue contains the following data: catalogue number, taxonomy, accession name, acquisition date, country of origin (FAO code), location of collecting site, geographical coordinates, elevation, collecting date, biological status (traditional variety/landrace), acquisition source (cultivated habitat/local market), donor of the accession, organizer of the collecting mission, type of germplasm storage, etc. The data is part of the GeneBank Information System in Bulgaria (https://genbank.uni-plovdiv.net) and Genetic Resources Information System of Slovakia – GRISS (http://griss.vurv.sk).

The Bulgarian and Slovakian genebank collections are documented by FAO/Bioversity descriptors and published in the European catalogue EURISCO (http://eurisco.ecpgr.org). They are presented with a valuable seed duplicate amount in the Svalbard Global Seed Vault.

Results and Discussion

As a result of the project activities, the collections in the genebanks of both countries have been enriched, and the conserved diversity was expanded (Fig. 1). The similar climatic conditions in Bulgaria and Slovakia are a prerequisite for the successful adaptation and sustainable use of the exchanged accessions in both countries.

Bulgarian collection is enriched with 67 accessions from the Slovakian genebank, including 13 accessions of cereals, 18 acc. beans, 10 acc. pea, 13 acc. pepper, 4 acc. pumpkin, 3 acc. tomato, leafy vegetables, and spices.

Slovakian genebank has been enriched with seed samples from 57 accessions in total, including 40 diverse accessions from the curators` collections in Sadovo (wheat, rye, oat, barley, triticale, common bean, cowpea, faba bean, bitter vetch, pea, chickpea, flax, and sesame) and 17 traditional Bulgarian varieties (common bean, peanuts, tomato, pepper, cabbage, cucumber and melon).

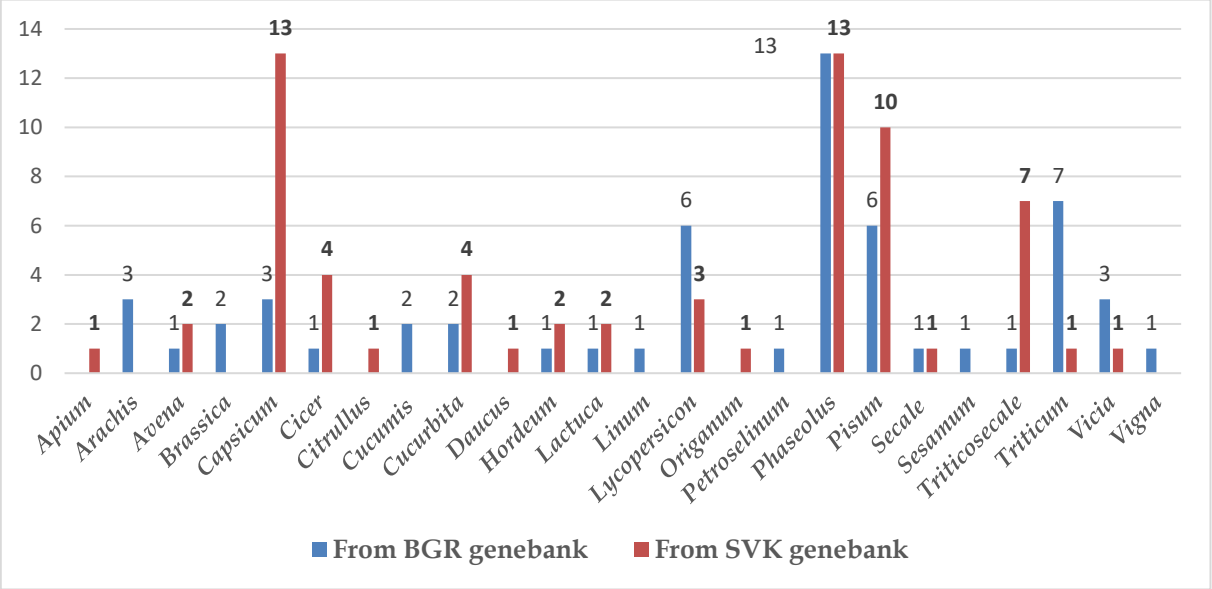

Fig. 1. Exchanged accessions by genus between Bulgarian and Slovakian genebanks through Standard Material Transfer Agreement (SMTA).

In 2024, the kick-off meeting of the project DIGIVALPGR took place at the Gene Bank in Piešťany, and an expedition was organized to monitor native species in the White Carpathians Protected Landscape Area. A team of scientists from three institutions carried out extensive monitoring of plant biodiversity and seed collection at 16 sites in the White Carpathians with the aim of documenting the diversity of local flora and contributing to the conservation, research, and use of plant species. During the research, 67 species of medicinal plants, fodder plants, and grasses were collected, which will significantly enrich the diversity of genetic resource collections in the Gene Bank of the Slovak Republic, where they will serve as a valuable basis for further study and protection of plant genetic resources.

In 2025, a second project workshop was held in Sadovo, and a joint expedition to collect local varieties was held in the village of General Inzovo, Yambol region. The farmer, who preserves on the farm traditional forms of cereals, legumes, vegetables, medicinal plants, and spices, donated seeds and shared valuable information related to the cultivation of crops, their specific features and requirements, and the directions of using the production. The eco-geographic and botanic surveys in the Southeast parts of Bulgaria, near the Black Sea coast, showed that the natural habitats are highly affected by urbanization practices and summer droughts. Also, a lavender field with five Bulgarian varieties in the garden collection at the Simeonova Mogila hill near Kableshkovo, Pomorie region was observed by Slovakian and Bulgarian researchers.

During 2024-2025, 43 accessions of local and traditional varieties were collected from 17 different localities in Bulgaria. Most of the villages are

situated in mountain and semi-mountain areas. The results of the farming surveys showed that all farmers in the mountainous areas are still predominantly using landraces of grain legumes and vegetables. In the case of the villages in the plain regions, only in some gardens, old farmers still use traditional varieties.

Between 2020 and 2025, collection missions were carried out in five different regions of Slovakia. During these expeditions, 153 items of plant genetic resources were collected, with an emphasis on medicinal plants. The project paid special attention to the White Carpathians Protected Landscape Area. After two years of intensive collection, 58 items of plant genetic resources were obtained from this unique landscape area. The White Carpathians are a unique region where natural wealth and historical human activity have created a harmonious landscape with high biodiversity. This area, which has been shaped by a sensitive approach to management in the past, is characterized by a diverse mosaic of ecosystems such as forests, meadows and pastures, copses, and small fields. The landscape is complemented by typical "kopanice" settlements with elements of traditional folk architecture and preserved customs, which give this area a special cultural dimension and increase its value for the collection of plant genetic resources. Sustainable management is key to this area, which is currently refocusing on restoring local and old fruit varieties and expanding pastures, thereby effectively protecting and maintaining high species diversity.

The status of collected accessions is presented in Tables 1 and 2. Diverse collection of common bean landraces from mountain, semi-mountain and plain areas in Bulgaria was created. Distribution of landraces in the explored regions of Slovakia shows still available rich plant diversity, which have to be preserved due to the climatic changes.

Table 1. Distribution of landraces in the explored regions of Bulgaria by DIGIVALPGR project.

Region	Municipality	Collecting site	Characteristic of the collecting area	Collected crops
Sofia	Svoge	Lakatnik	Mountain area, Stara Planina	common bean, corn
		Osenovlag	Mountain area, Stara Planina	common bean
Vratsa	Mezdra	Ochinpol	Mountain area, Stara Planina	common bean, medicinal plants
	Biala Slatina	Komarevo	Plain, near the Scut River	melon, watermelon
	Krivodol	Krivodol	Plain	melon, watermelon
Pazardzhik	Bratsigovo	Bratsigovo	Semi-mountain area, Rhodopes	common bean, tomato
	Sarnitsa	Sarnitsa	Mountain area, Rhodopes	common bean, pumpkin
	Velingrad	Mecho Korito	Mountain area, Rhodopes	common bean
	Pazardzhik	Sinitovo	Plain, vegetable production area	pumpkin
Smolyan	Smilyan	Smilyan	Mountain area, Rhodopes	common bean
	Madan	Visokite	Mountain area, Rhodopes	common bean
Blagoevgrad	Petrich	Kluch	Semi-mountain area, Pirin-Belasitsa	cowpea
	Strumiani	Nikudin	Semi-mountain area, Pirin-Ograzhden/ Malashevska	melon, pumpkin
Yambol	Tundzha	General Inzovo	Plain, vegetable production area	tomato, cowpea, medicinal plants
Plovdiv	Sadovo	Sadovo	Plain, vegetable production area	common bean
	Maritsa	Radinovo	Plain, vegetable production area	pumpkin
* Data source – GeneBank Information System of IPGR-Sadovo				

Table 2. Distribution of landraces in the explored regions of Slovakia in the DIGIVALPGR project.

Region	Municipality	Collecting site	Characteristic of the collecting area	Collected crops
Trenčín	Púchov	Lednica	unmowed xerothermic meadow	horseradish, carrot, medicinal plants, forage
	Trenčín	Skalka nad Váhom	unmowed xerothermic meadow	parsnip, horseradish, medicinal plants, grasses
	Ilava	Vršatecké podhradie	margin of the mowed meadow	medicinal plants, forage, grasses
Banská Bystrica	Turčianske Teplice	Sklené	unmowed xerothermic meadows on limestone	carrot, parsnip, medicinal plants, forage
	Žiar nad Hronom	Krahule	mesophile meadow	parsnip, medicinal plants, grasses, forage, poppy
	Žiar nad Hronom	Jastrabá	xerothermic meadows	medicinal plants, forage, grasses, carrot
Žilina	Námestovo	Oravská Lesná	mesophile meadow	medicinal plants, grasses
	Tvrdošín	Brezovica	mesophile meadow	parsnip, carrot, medicinal plants, grasses
	Tvrdošín	Oravský biely potok	private garden	common bean, poppy, garlic
Nitra	Levice	Santovka	mesophile meadow	medicinal plants, grasses, carrot
	Levice	Levice	unmowed meadows	garlic, forage
	Levice	Beša	old orchard	medicinal plants, forage, grasses, carrot
Košice	Rožňava	Jabloňov nad Turňou	unmowed xerothermic meadows	medicinal plants, forage
	Rožňava	Plešivec	unmowed xerothermic meadows	medicinal plants, grasses
	Levoča	Hrhov	humid meadow	medicinal plants, carrot
* Data source – Genetic Resources Information System of Slovakia – GRISS				

During the expeditions, data for the locality and information from farmers growing the local varieties were collected using the developed questionnaire. The information is helpful in order to ensure the possibility of returning landraces to the site from which they were collected after their long-term conservation, evaluation, characterization, and multiplication for all users. According to the breeding purposes, the new knowledge about the distribution of landraces and agro-climatic characterization is useful for the selection of those accessions and populations that belong to localities where these species and environmental conditions are found. Also, the organic farmers are looking for genetically diverse varieties for better production stability and for higher yields in the ecologically friendly technology.

The advantages of growing local and old cultivars, which were reported by farmers against advanced cultivars are: competitive yield under low inputs; special value as traditional taste, some economical advantage (local market, agrotouristic products); biomass yield with very good nutritional quality for the livestock; tolerance to abiotic and biotic stress; environmental advantage. Most of the products of landraces have a higher price and are more suited for traditional dishes.

The activities of the DIGIVALPGR project are focusing on preserving the crop heritage alive. The general public could request a small seed amount from both genebanks to grow and propagate further.

By sharing good practices in the field of genebank documentation, collecting valuable data and new accessions through expeditions and germplasm exchange using Standard Material Transfer Agreement, the study increases the diversity of the National collections in Bulgaria and Slovakia,

following the priorities of EU Biodiversity 2030 Strategy (Hermoso et al., 2022). The interdisciplinary approach integrates agricultural sciences and information technologies, that facilitating the modernisation of both genebank information systems and supports practical use of the achievements.

In the era of digitalization, the results improve the quality of data management and sharing new knowledge through local plant genetic resources cataloguing in accordance with EURISCO descriptors (FAO/Bioversity, 2017) and addressing the Nagoya Protocol (CBD, 2011), which emphasizes the importance of public awareness of genebanks. Results include the development of optimised databases and web-based tools for public open access to the gene pool and equitable sharing of benefits from the use of genetic resources under the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA, 2009).

Conclusions

The study has an impact beyond academia, as it contributes to sustainable and diverse food production through the valorization of traditional, regional, and old varieties, facilitating their reintroduction into home gardens and farms.

The results correspond to landraces preservation through inventoring the diversity and exploring the environmental conditions in rural and mountain areas in line with the National conservation programs of Bulgaria and Slovakia.

The solutions, achieved by the international team, prove the hypothesis and find their application in the overall process of preserving biodiversity and nature in both countries, increasing the resilience of crops in dynamic environmental conditions, and guaranteeing the production of clean and high-quality food.

Acknowledgements

This research work was carried out under the project DIGIVALPGR "Digitalization and valorisation of local plant genetic resources in Bulgaria and Slovakia in the framework of maintaining compatibility and interoperability in the European area" with the support of the Bulgarian National Science Fund, Contract number KP-06-Slovakia/9/13.08.2024 and Slovak Research and Development Agency, Contract number SK-BG-23-0005/17.09.2024.

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Received: 01.07.2025
Accepted: 08.05.2026