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# Development of plant genetic resources' collections and associated passport information through bilateral projects between Bulgaria and China

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## Abstract

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The geographical latitude, climate and agro-ecological conditions, as well as the agricultural production of Bulgaria are similar to some of the regions of Northern China. In this context, the exchange of plant genetic resources and associated information between the two countries could assist in achieving the sustainable development common goal and respond to global climate challenges. This is the reason for the successful applicability of the achieved scientific results from joint research projects in the area of plant diversity preservation with a potential to create innovations being a donor of valuable traits for crop breeding of new varieties such as high yield, improved biological qualities and resistance. The aim of the study is to evaluate the enrichment of collections through passport information in the National register of plant genetic resources and identifying new priorities for cooperation as digitalization. Since 2007 through the implementation of six bilateral projects, over 25 expeditions in rural areas of Bulgaria were conducted. Cooperation networks of scientists between the two partner countries were created, too. 1149 accessions of local plant genetic resources from cereals, grain legumes, vegetables, medical and aromatic species were collected and exchanged with a view to their long-term conservation in Bulgarian and Chinese genebanks and sustainable use. During the period 1982–2013 the Bulgarian genebank has been enriched with 231 accessions through international free germplasm exchange from three research organizations of the People's Republic of China, of which 133 are characterized with Chinese origin. The development of collections in Bulgarian genebank represents diverse genetic material, well documented and stored for present and future generations.

*Keywords:* plant diversity; collecting missions; rural areas; introduction; passport database; international collaboration; sustainable agriculture

## Introduction

Having established diplomatic relations with China more than 70 years ago, Bulgaria is a vital country and a partner along the Silk Road. Nowadays The Belt and Road Initiative is a solid base for the advancing cooperation in education, science and technology, and cultural exchange between the two countries. The fruitful cooperation between the two countries can be further expanded in the field of agriculture. Initiated cooperation is based on the promotion of agricultural science and technology under strategic frameworks such as the 16+1 between China and Central and Eastern European Countries. Bulgaria provides a solution to developing the agro-food sector because of the following specifics and prerequisites: Unique natural conditions for cultivation of wide diversity of traditional crops; Ecologically clean and fertile soils; Very high quality of organic products (ban on GMOs); Established local

producers and a strong tradition in the agricultural sector (Liu, 2017; Kandilarov, 2019).

The geographical latitude, climate and agro-ecological conditions, as well as the agricultural production of Bulgaria are similar to some of the regions of Northern China (Bachev, 2018). In this context, the exchange of plant genetic resources and associated passport, characterization and evaluation information between the two countries could assist to achieve the sustainable development common goal and respond to global climate challenges. This is the reason for the successful applicability of the achieved scientific results from joint research projects in the area of plant diversity preservation with a potential to create innovations being a donor of valuable traits for crop breeding of new varieties such as high yield, improved biological qualities and resistance.

For increasing the availability and sustainable use of landraces, conserved in *ex situ* collections, additional resources must be directed towards collection, evaluation, documentation and storage of local accessions. The germplasm collecting missions have the following main goals: preventing genetic erosion; expanding or completing the genetic base available in the existent collections; meeting specific needs: breeding programs, research or development (Rocha et al., 2017).

In search for the concept of sustainable development as relationships between elements of agro-biodiversity, climate change, and the food chain, public awareness for rational exploitation of plant genetic resources and maintaining the traditional knowledge related to agricultural practices is critically important (Khan, 2022).

Well-organized documentation and comprehensive information data management is a prerequisite for the further development of genebank collections (Weise et al., 2020).

The aim of the study is to evaluate the development of plant genetic resources' collections and associated passport information through implementation of bilateral projects between Bulgaria and China as well as identifying new priorities for cooperation.

## Material and Methods

The genetic diversity of Bulgaria is preserved in 19 research institutes at the Agricultural Academy (FAO, 2016). A total number of over 160 000 plant forms are maintained in various collections – over 100 000 field crops, over 5000 vegetable crops, over 40 000 perennials and over 130 essential oil crops.

The National Seed Genebank, situated at the Institute of Plant Genetic Resources (IPGR) in Sadovo (FAO Institute code: BGR001) contains 65 346 seed accessions, which categorize it as the richest *ex situ* collection of plant genetic resources in Southeast Europe (http://eurisco.ecpgr.org). A specialized genetic collection is maintained in the Agrobioinstitute – Sofia, as well as working collections for the economically important crops are preserved at Breeding Institutes.

Conservation and sustainable preservation of the plant biodiversity from wild and cultivated flora is the main priority of the IPGR-Sadovo as a National Coordinator in the European Programme for Plant Genetic Resources (ECPGR).

The Centre for Information and Documentation of plant genetic resources has been established in 1982 and completely renovated in 2021 under a project BGPlantNet, financed by Bulgarian National Science Fund (Grant KP-06H36/2/13.12.2019). It is responsible for updating the National Inventory data on EURISCO Server with full free access (Kotni et al., 2022). According to the international documentation standard Multi-Crop Passport Descriptor (FAO/Bioversity, 2017) the electronic register contains the following data: catalogue number, taxonomic description, accession name, acquisition date, country of origin (FAO code), location of collecting site, geographical coordinates, elevation, collecting date, biological status (wild, traditional cultivar/landrace, breeding/research material, advanced or improved cultivar), acquisition source (wild or cultivated habitat, market, research organization/ genebank, seed company), donor of the accession, organizer of the collecting mission, type of germplasm storage (seed collection – short, medium or long term; field or *in vitro* collection), location of safety duplication, etc. The taxonomic description of the crops is under the nomenclature of USDA (GRIN, 2015).

According to the Plant Genetic Resources Strategy for Europe (ECPGR, 2021) the main activities are focused on: (1) Mapping and collecting plant genetic resources – organizing expeditions for inventorying crop diversity and its wild relatives, saving information about *in situ/* on farm preservation and collecting accessions for *ex situ* conservation; (2) Sustainable management of genebank collections; (3) Documentation and transfer data to National and International networks; (4) Phenotypic and genotypic evaluation and characterization; (5) Making the conserved collections available for research and development, teaching purposes, crop breeding, and agricultural practice – exchange in accordance with ITPGRFA (2009) and Nagoya Protocol (CBD, 2011); (6) Expanding the use of plant diversity – cooperation with research institutions, international collaboration, reintroduction of the local and traditional varieties to home gardens, promoting exhibitions, publications, media coverage, etc.

Collection of locally adapted traditional crop varieties and wild relatives is carried out by implementing the targeted projects on theme "Conservation, evaluation, maintenance and sustainable use of plant genetic resources in Bulgaria" at the Agricultural Academy and by research projects with external funding – National Scientific Programs, FAO and EU funded projects, bilateral cooperation with partners from China, etc.

The collecting missions are conducted under the methodology of Guarino et al. (2011).

## Results and Discussion

Bulgaria and China are countries where there are favorable conditions for the cultivation of a rich variety of species and varieties. Taking into consideration the aging of the population and the depopulation of rural areas, combined with natural disasters such as floods, drought, etc. of an unpredictable nature, the danger of losing the wealth of local varieties and crop wild relatives is substantially high. Vegetables and grain legumes are grown in home gardens, and the surplus is exported to the market, in addition to being a subsidiary farm for the household. Old varieties of cereals are maintained for traditional production of area-specific foods related to local customs.

The National Collection of plant genetic resources in IPGR–Sadovo are enriched annually with an average of about 200–250 accessions new germplasm, mainly from the country through conducting collection missions and international free germplasm exchange.

During the period 1982-2013, the Bulgarian genebank has been enriched with 231 accessions through international free germplasm exchange from three research organizations of the People's Republic of China, of which 133 are characterized with Chinese origin. IPGR-Sadovo implements good collaboration with Institute of Crop Science, Chinese Academy of Agricultural Sciences (FAO Institute code: CHN001), Institute of Horticulture, Heilongjiang Academy of Agricultural Sciences – Harbin (FAO Institute code: CHN117) and Shanghai Botanic Garden (FAO Institute code: CHN219).

Since 2007 through the implementation of six bilateral projects with China over 25 expeditions in Bulgarian rural areas were conducted (Table 1) as well as germplasm, exchange and cooperation networks of scientists between the two partner countries were created. 1149 accessions of plant genetic resources, including 954 acc. with Bulgarian and 195 acc. with Chinese origin, from cereals, forages, grain legumes, vegetables, medical and aromatic species were collected and exchanged with a view to their *ex situ* conservation in Bulgarian and Chinese genebanks.

Villages, sufficiently distant and with different ecological and geographical characteristics in Bulgaria were selected. The priorities of expeditions are: collecting variability in a particular crop or crop group; collecting tolerant forms to biotic and abiotic stress; collecting crop wild relatives, weedy types and related taxa of agri-horticultural relevance.

A high number (91 acc.) of *Triticum* landraces from *Tr. boeoticum* (81 acc.), *Tr. dicoccon* (2 acc.) and *Tr. monococcum* (8 acc.) were collected from regions of South Bulgaria (regions of Burgas, Yambol, Haskovo, Kurdzhali, Stara Zagora, Plovdiv and Kustendil).

Grain legumes occupy about 25% of the collected local accessions by BGR-CHN bilateral projects, represented by 241 acc., including 214 acc. with Bulgarian origin (1 acc. *Cicer arietinum*, 13 acc. *Phaseolus coccineus*, 198 acc. *Phaseolus vulgaris* and 2 acc. *Vigna* sp.) and 27 acc. *Phaseolus vulgaris* from Harbin, China. The local Bulgarian bean accessions were collected from the villages around Smolyan, Velingrad, Pazardzhik, Samokov, Sofia, Plovdiv, Kazanlak, Stara Zagora, Yambol, Burgas, Strandzha, Haskovo, Dimitrovgrad, Svilengrad, General Toshevo, Vratza, Lovech.

The Cucurbits group includes 53 accessions: 42 acc. with Bulgarian local origin – *C. maxima* (9 acc.), *C. moschata* (7 acc.) and *C. pepo* (26 acc.) and 11 acc. *C. pepo* from Harbin, China. During the expeditions in Bulgaria traditional varieties of tomato (41 acc.), pepper (132 acc.), eggplant (13 acc.), onion crops (56 acc.), cabbages (23 acc.) and leafy vegetables (14 acc.) were collected. Landraces of medicinal and aromatic plants (123 acc.), used in bio and home gardens for medicinal purposes, herbal teas and decoration, were collected.

Regions and farmers of the country, conserving on farm unique local old and traditional varieties have been identified (Table 2). Ethnobotanic data and other information of interest regarding aspects related to the cultivation, utilization and genetic erosion process were also recorded. By using evaluation and characterization descriptors of Biversity International and statistical data analysis a relatively high biological diversity in the einkorn, grain legume and vegetable collections was determinated by Desheva et al. (2019), Krasteva et al. (2013), Velcheva et al. (2013) and Stoilova et al. (2014).

A database for *in situ* conservation with description of locations, geographical coordinates, elevation and associated species of the investigated areas with crop wild relatives and medicinal plants in Strandzha and Rodopi mountain, South Dobrudzha, North Black Sea region has been created and added in the National Register of Plant Genetic Resources.

Currently, two local potato varieties from the village Dorkovo near Velingrad and 7 acc. from Harbin, China are conserved *in vitro*. The two Bulgarian varieties are main-

**Table 1. Enrichment of IPGR-Sadovo genebank collection with valuable local accessions of plant genetic resources through bilateral projects between Bulgaria and China (2007–2022)**

| Research project | Partner from China | Period | Collected local germplasm accessions | | |
|---|---|---|---|---|---|
| | | | From Bulgaria | From China | Total numb. |
| Local plant genetic resources for sustainable agriculture | Pratacultural Science Institute of Heilongjiang Agricultural Academy – Harbin | 2006–2009 | 79 acc. (forages) | – | 79 acc. |
| Improvement of the usability and methods for the preservation of germplasm stored under the conditions of the genebanks of Bulgaria and China | Institute of Crop Science, Chinese Academy of Agricultural Sciences – Beijing | 2008–2011 | 30 acc. (forages) | 30 acc. (forages) | 60 acc. |
| Collection, storage and study of the genetic resources of cultivated plants | Institute of Crop Breeding, Heilongjiang Academy of Agricultural Sciences – Harbin | 2008–2009 | 93 acc. (forages, grain legumes and vegetables) | 67 acc. (forages, grain legumes and vegetables) | 160 acc. |
| Inventory and collection of local plant genetic resources from vegetable and aromatic crops with a view to their conservation and target use | Institute of Horticulture, Heilongjiang Academy of Agricultural Sciences – Harbin | 2011–2013 | 181 acc. (grain legumes, vegetables and medicinal plants) | 98 acc. (grain legumes, vegetables, medicinal plants) | 279 acc. |
| Inventory and collection of local plant genetic resources from vegetable and aromatic crops with a view to their conservation and target use (extension–2nd period) | Institute of Horticulture, Heilongjiang Academy of Agricultural Sciences – Harbin | 2015–2016 | 421 acc. (grain legumes, vegetables and medicinal plants) | – | 421 acc. |
| Plant genetic resources of the genus *Triticum* – storage and use in the national genebanks of China and Bulgaria | Institute of Crop Science, Chinese Academy of Agricultural Sciences – Beijing | 2016–2018 | 91 acc. (cereals) | – | 91 acc. |
| Enriching of the grain legumes diversity between Bulgaria and China – introduction and evaluation in relation to global climate change | Institute of Crop Science, Chinese Academy of Agricultural Sciences – Beijing | 2021–2022 | 59 acc. (grain legumes) | – | 59 acc. |
| Total number | | | 954 | 195 | 1149 |

* The source of data is the National Register of Plant Genetic Resources "Phyto 2000" and the Annual International Relations Reports, IPGR-Sadovo (2006–2021)

tained in the field collection in the experimental area of IPGR at Koprivshtitza.

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 conservation of significant amounts of intra-specific genetic diversity of useful plant species

**Table 2. Regions in Bulgaria, inventored by bilateral projects between Bulgaria and China (2007–2022)**

| Crop groups | Regions in Bulgaria, inventoried by BGR-CHN bilateral projects |
|---|---|
| Cereals, forages | Regions with extensive agriculture, including plains, mountainous and semi-mountainous – South-East and South-West parts of the country, closed border regions, monastery lands, etc. |
| Grain legumes, potatoes | Mountainous and semi-mountainous regions – Rodopi and Strandzha mountains; home gardens in villages in South and North Bulgaria, including Dobrudzha |
| Vegetable crops | All home garden regions near Gorna Oryahovitsa, Veliko Tarnovo, Svishtov, Vidin, Plovdiv, Pazardzhik, Haskovo, Dimitrovgrad, Petrich, Sandanski, etc. |
| Cucurbits | All home garden regions near Pleven, Vidin, Razgrad, Shumen, Yambol, Lyubimets, Svilengrad, Ivailovgrad, Harmanli, etc. |
| Medicinal and aromatic plants | Home gardens, monastery lands, mountainous and semi-mountainous regions. |

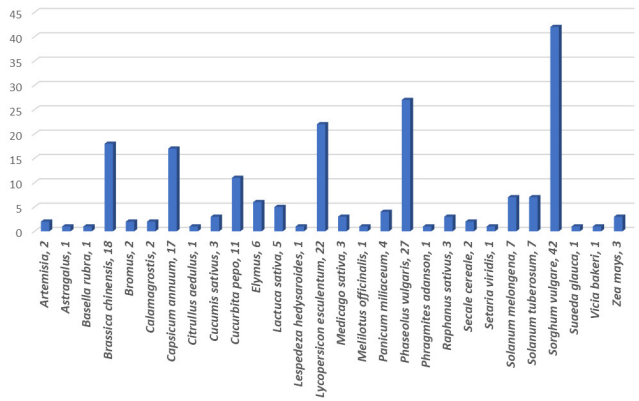


**Fig. 1. Germplasm accessions with local Chinese origin in Bulgarian genebank collections**

(Kehlenbeck et al., 2007; Galluzzi et al., 2010).

During the period 2008–2012 by bilateral projects the collections in the genebank in Sadovo were enriched with 195 accessions with local Chinese origin (Table 1). With the highest number of accessions are sorghum, bean, tomato, cabbage and pepper (Figure 1).

In 2012 visits of two scientists from IPGR-Sadovo in the Heilongjiang Agricultural Academy and two scientists from the Institute of Horticulture – Harbin in Bulgaria were conducted. Seeds and associated passport information have been exchanged between partners. From a special interest of Bulgarian genebank for enriching the species diversity are 18 local Chinese cabbage (*Brassica chinensis*) accessions from the area of the city of Harbin.

In 2017 four scientists from IPGR visited the genebank in Beijing by billateral project, and in 2018, four scientists from the Chinese Academy of Agricultural Sciences visited Institute in Sadovo.

In Bulgaria there are conditions for environmentally sustainable agriculture and production of unique food and beverages by authentic methods. The added value of the activities of small and medium-sized enterprises using local resources are socio-economic and environmental benefits for the regions (Ivanova et al., 2021). Organic production is still weak in the country, but the market for organic products is developing rapidly. The prerequisites for the development of this type of production and the factors motivating farmers in this direction are the rich diversity of natural resources, ecologically preserved areas, the perceived benefits for rural development, the growing demand for healthy food from consumers and the existence of a legal framework. Considering all these possitive conditions in Bulgaria and the high economic development of China the partnership is extremely important not only in the field of agricultural science, but also in education and specialization of researchers.

According to the cooperation between the Agricultural Academy and China during the period 2015-2016 five researchers from IPGR-Sadovo attended seminars for training and exchange of good practices, organized by the Ministry of Commerce of People's Republic of China and financed by Chinese Government: (1) Seminar on Agricultural Mechanization, conducted at the Chinese Academy of Agricultural Mechanization Sciences (CAAMS), Beijing; (2) Seminar on Agricultural Marketing and Management, conducted at the China Agricultural University, Beijing; (3) Training Course on New Technology of Tropical Agriculture, conducted at Chinese Academy of Tropical Agricultural Sciences (CATAS), Haikou, Hainan Province; (4) Seminar on Agro-Technology Extension System Building and Management, conducted at National Agricultural Technology Extension and Service Center (NATESC), Beijing; (5) Seminar on Agricultural Bio-Technology, conducted at National Agro-Tech Extension and Service Center (NATESC), Beijing.

## Conclusions

Since 2007 through the implementation of six bilateral projects with China over 25 expeditions in rural areas of Bulgaria were conducted and cooperation networks of scientists between the two partner countries were created.

A mutual exchange of seed material and passport information to enrich the genebanks of China and Bulgaria was carried out.

954 accessions of farmers' varieties from home gardens, preserved on farm, and crop wild relatives from natural habitats were collected, but further work on evaluation and characterization of these valuable accessions continues.

A database for *in situ* conservation, including the investigated areas with crop wild relatives and medicinal plants was created.

Although Bulgaria has gained achievements in collection of local varieties and crop wild relatives and significant development of *ex situ* collections, there is still a large number of unexplored territories rich with landraces and this, combined with challenges such as dynamic rural depopulation, population aging and climate changes, creates a real danger local plant diversity to be lost.

Based on bilateral partnership, IPGR-Sadovo is implementing joint research projects with partners from China towards plant genetic resources conservation.

Regarding the access and sustainable use of this valuable source for crop breeding and sustainable agriculture IP-

GR-Sadovo is open for collaboration in new projects with Chinese research organizations and trainings, focused on documentation and digitalization of plant biodiversity.

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## References

**Bachev, H.** (2018). Comparative Analysis of Governance and Level of Agrarian Sustainability in Bulgaria and China. In: *Governing and Assessment of Agrarian Sustainability in Bulgaria and China*, Institute of Agricultural Economics, Sofia, ISBN 978-954-8612-12-8.

**CBD** (2011). Nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation to the Convention on Biological Diversity. United Nations Environmental Programme, https://www.cbd.int/abs/.

**Desheva, G., Valchinova, E., Uzundhalieva, K. & Kyosev, B.** (2019). Agro-morphological characterization of wild einkorn wheat accessions collected on the territory of South Bulgaria. *Journal of Mountain Agriculture on the Balkans, 22*(6), 74-87. ISSN: 1311-0489.

**ECPGR** (2021). Plant Genetic Resources Strategy for Europe. Rome, Italy. https://www.ecpgr.cgiar.org/fileadmin/bioversity/publications/pdfs/PGR_STRATEGY_LP_22_Nov_revised.pdf.

**FAO** (2016). The state of Bulgaria's Biodiversity for Food and Agriculture. Country report, Rome, Italy, https://www.fao.org/3/CA3481EN/ca3481en.pdf.

**FAO/Bioversity** (2017). Multi-Crop Passport Descriptors. Rome, Italy, https://www.ecpgr.cgiar.org/fileadmin/templates/ecpgr.org/upload/EURISCO/EURISCO_MCPD2_descriptors_updated_November_2017.pdf.

**Galluzzi, G., Eyzaguirre, P. & Negri, V.** (2010). Home gardens: neglected hotspots of agro-biodiversity and cultural diversity. *Biodiversity and Conservation, 19*(13), 3635-3654, DOI: 10.1007/s10531-010-9919-5.

**GRIN** (2015). Genetic Resources Information Network, Taxonomy for Plants, USDA.

**Guarino, L., Ramanatha Rao, V. & Goldberg, E.** (2011). Collecting Plant Genetic Diversity: Technical Guidelines – 2011 Update. Bioversity International, Rome, Italy, ISBN 978-92-9043-922-6.

**ITPGRFA** (2009). International Treaty on Plant Genetic Resources for Food and Agriculture. Rome, Italy, https://www.fao.org/plant-treaty/en/.

**Ivanova, T., Bosseva, Y., Chervenkov, M. & Dimitrova, D.** (2021). Enough to Feed Ourselves! – Food Plants in Bulgarian Rural Home Gardens. *Plants*, *10*(11), 2520, https://doi.org/10.3390/plants10112520.

**Kandilarov, E.** (2019) Bulgaria External Relations Briefing: Foreign Policy and International Relations of Bulgaria 2019 – Outlook. China – CEE Institute, Weekly Briefing, ISSN: 2560-1601, *14(4),* 6, https://china-cee.eu/wp-content/uploads/2019/04/2019er0156-%EF%BC%8815-Bulgaria.pdf.

**Kehlenbeck, K., Arifin, H. S. & Maass, B. L.** (2007) Plant diversity in homegardens in a socio-economic and agro-ecological context. In: Stability of Tropical Rainforest Margins. *Springer,* Berlin, Heidelberg, 295-317. DOI: 10.1007/978-3-540-30290-2_15.

**Khan, S. A. K. U., Rahman, M. & Islam, M.** (2022) Agro-Biodiversity Across the Food Chain. In: Biodiversity, Functional Ecosystems and Sustainable Food Production. *Springer*, Cham, 1-40, https://doi.org/10.1007/978-3-031-07434-9_1.

**Kotni, P., van Hintum, T., Maggioni, L., Oppermann, M. & Weise, S.** (2022). EURISCO update 2023: the European Search Catalogue for Plant Genetic Resources, a pillar for documentation of genebank material. *Nucleic Acids Research,* https://doi.org/10.1093/nar/gkac852.

**Krasteva, L., Neykov, St., Velcheva, N., Chavdarov, P., Zhan, Y., Guo, M. & Tsvetkov, Y.** (2013). Inventory and collection of local genetic resources from vegetable crops for their conservation and targeted use. Republic of Srpska. *Agro-Knowledge Journal, 14*(1), 97-104. DOI: 10.7251/AGREN1301097K.

**Liu, Z.** (2017). The "16+ 1 Cooperation" under the "Belt and Road" initiative. In: *China's Relations with Central and Eastern Europe*. Routledge, 2017, 29-47, ISBN 9781315226644.

**Rocha, F., Gaspar, C. & Barata, A. M.** (2017). The legacy of collecting missions to the valorisation of agro-biodiversity. *Agriculture & Forestry, 63*(2), 25-38, DOI: 10.17707/AgricultForest.63.2.02.

**Stoilova, T., Berova, M., Kuzmova, K. & Stamatov, S.** (2014). Study on diversity of *Phaseolus spp.* landraces with reference to global climate change. *African Journal of Agricultural Research*, *Academic Journals*, *9*. 2925-2935, DOI: 10.5897/AJAR2013.8135.

**Velcheva, N., Krasteva, L., Chavdarov, P. & Neykov, S.** (2013). Application of statistical methods for evaluation of local *Phaseolus vulgaris* L. experimental data. Republic of Srpska. *Agro-Knowledge Journal*, *14*(3), 421-429, DOI: 10.7251/AGREN1303421V.

**Weise, S., Lohwasser, U. & Oppermann, M.** (2020). Document or lose it – on the importance of information management for genetic resources conservation in Genebanks. *Plants, 9*(8), 1050, DOI: 10.3390/plants9081050.

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