

EXPLORATION AND COLLECTION OF MULTI-CROP LEGUME GERMPLASM FROM KORÇA REGION, ALBANIA

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ABSTRACT

Legumes and pulses play a prominent role in human and animal diets, sustainable crop production and fostering biodiversity-based agriculture. Although very important to the human food supply and security, their genetic diversity is underestimated. Albania, and Korça region in particular is rich in legume genetic resources. Many local varieties legumes continue to be cultivated in Korça region, due to farmers' agronomic, culinary, or quality preferences, and tradition. Unfortunately, there is an unknown number of the lost landraces over the last 30 years is concerning. There are areas where only cursory collecting or no collecting of their traditional varieties has ever been done. The present paper informs about the collecting expeditions of local legume germplasm carried out for conservation purposes due to their genetic erosion and climate change impact. Survey and collection of legume germplasms was carried out from 2021-2022, and the results reported a significant diversity in the species' local germplasm. In total, there are 77 seed samples of accessions in fourteen legume crops collected, and collection includes accessions of common bean, runner bean, green common bean, pea, cowpea, chickpea, grass pea, bitter and common vetch, fenugreek etc. to address conservation of diversified legume accessions and protection from genetic erosion. Such germplasm would be useful to study resistant cultivars to adverse climatic conditions to cope with the changing climate.

Key words: legumes, local varieties, genetic resources, common bean, blue fenugreek

1. INTRODUCTION

Albania is one of the floristically richest European countries, especially with respect to its limited surface area of only 28 748 square kilometers, and one of the most mountainous countries with a flora of ca. 4000 taxa of vascular plants occurring in the wild (Lack and Barina 2020), which represents approximately 30% of the entire flora species found in the continent. In Albania there are 32 endemic taxa and 160 near endemic species of vascular plants. Geographical position, geological and hydrological

characteristics, climatic, topographical and soil conditions are the main drivers of flora and vegetation making the country rich in plant genetic resources for food and agriculture.

Jani *et al.*, (2020) said that agrobiodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants, and micro-organisms, at genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure, and processes. Consequently, it is of crucial importance for food and nutrition security of an ever-increasing population. One of the most threatened components of agricultural plant genetic resources are crop landraces that are strongly linked to the biological, cultural, and socio-economic contexts where they have been developed (Conversa *et al.*, 2020). Old landraces and obsolete cultivars represent a national heritage that must be conserved for future generations. Those are largely endangered due to lack of their systematic conservation.

The genetic diversity of legume crops is important to food supply and security for humans and livestock, and the future of agrobiodiversity (Zhang *et al.*, 2022). Grain legumes (pulses) are a key source **for human** nutrition and animal feed, by providing the necessary protein, energy, dietary fibre, minerals, vitamins and phytochemicals, biologically active substances required for human health. Pulse crops are plants from the legume family (Fabaceae) that are strictly harvested for their dried seeds, while other members are grown for vegetables, forage, and other uses. So, pulses do not include legumes with high levels of oil or moisture at the time of harvest. An essential strategy to address food supply and security would be to use local varieties as a source of food health, environmental well-being, and a more sustainable agricultural system (Hernández-López *et al.*, 2022).

Korça region is one of the richest areas in plant genetic resources for food and agriculture in Albania. There is a long history of different local varieties and landrace crops being cultivated in the traditional agroecosystems of this region, despite their genetic erosion and heavily marginalized and declined cultivation in recent decades. Traditional agroecosystems are refuges for agrobiodiversity and local races in different cultures. Landraces continue to play a role in agricultural production in Korça region. Smallholder farmers, especially the inland areas, maintain diverse landraces in their fields or home gardens due to agronomic, culinary, or quality preferences and because they provide adaptability to marginal conditions, yield stability, commercial opportunities in markets, and high quality and/or cultural significance values of product. The diversity of these genetic resources is poorly explored, and no detailed studies are available. Local varieties of legumes demonstrate

differentiation to local environmental conditions. Their major advantages are adaptation to their specific agrosystems and low input requirements in traditional agriculture practices. Preservation of landraces is timely and urgent because the rate of local genetic and cultural erosion is very high, hampering the potential for innovation in sustainable agriculture and for counteracting the decline in community and cultural diversity (Torricelli *et al.*, 2016; Conversa *et al.*, 2020).

Recognition of the value of landrace diversity and concern about its erosion on farms have led to sustained efforts to establish ex situ collections worldwide (Ramirez-Villegas *et al.*, 2022). Concerning the preservation of plant genetic resources for food and agriculture in Albania, the greatest efforts have been made for the ex-situ conservation. Ex situ techniques should always be seen as **complementary to in situ conservation**, aiding species recovery and reintroduction. Here development of community seed banks would be appropriate for the landrace preservation is the development of community seed banks. The community seed bank is an approach that provides farmers access to seeds of local crop varieties, and it serves as a repository of associated knowledge and institution to organize, mobilize, and represent farmers' interests (Shrestha *et al.*, 2013). In 2021, a community seed bank was established in Korça region to promote conservation and sustainable use of local variety seeds for seed and food security, and to improve the livelihoods of farmers. Currently, it is still at its initial stage, however approximately 195 accessions of different landrace vegetables and grains have been collected and stored so far.

In order to define a plan efficient for on-farm sustainable management and maintenance of landraces, is important to collect and conserve landraces, which have been conserved and used by different communities, as part of their tradition. This paper reports the results of a survey carried out in Korça region, mentions for its diversity of traditional varieties of legumes, for the exploration of crop landraces legumes in Korça region to address their collection and preservation at the National Gene bank and Community seed bank of Korça, ensuring the availability of this diversity for future generations, and the multiplication and provision of good quality seeds for small-scale farmers in the region.

2. MATERIALS AND METHODS

The study area

The assessment of local landraces and varieties was carried out in the Korça region. Geographically, this region is located on the south-east of Albania, bordering Greece, and the Republic of North Macedonia in the east. In addition, it includes the municipality of Devolli, Kolonja, Korça, Pogradeci

and Pusteci, covering a total area of ca. 3,711 km² (Shuka *et al.*, 2022a), making the region the largest one in the country. The altitude varies from 500 m above sea level to 2520m (Gramozi Mt.). The average elevation above sea level is 850 m. The mountains cover 58% of surface area and extend between the Mediterranean and Alpine biogeographic regions. The valleys are under the influence of Mediterranean climate, and the areas with altitude above 1200 m, particularly the eastern portion of the region are characterized by the continental climate— cold and dry winter, and hot summer with temperatures up to 30°C (August). The average annual temperature is 10.5°C. The average seasonal temperature is 1.7°C in winter, 9.3°C in spring, 19.3°C in summer and 11.5°C in autumn (Jani *et al.*, 2020). WGB (2021) stated that the lowest temperatures were recorded in Sheqeras (−25.8°C) and Voskopojë (−25.6°C), while the absolute maximum recorded is 35.5°C. Shuka *et al.*, (2022b) stated that the region is characterized by low average annual precipitation, ca. 800-1000 mm per year. November marks the highest precipitation level, while July and August mark the lowest precipitation level. The total number of days with snow in the region varies from 30-35 in the lower regions to 80–90 days in the highest ones (Kabo 1990-1991). The main surface of agricultural land in this region is the Korça field with a surface area of 108 km² (Jani *et al.*, 2020). The average agricultural land area by farm size varies from 1.1 to 1.5 Ha.

Plant materials

The Korça region is one of the richest areas in plant genetic resources for food and agriculture in the country and a hotspot for crops landraces. The present paper informs about the local plant genetic diversity of legumes crops. The collection covered all the genotypes of the crops growing in the region. Environmental conditions, geographic position, landscape characteristics, and history and culture, make it the crop landrace home to a number of crop species. Farmers have preserved the local varieties and landraces, based on the long history of production of special crops.

Field surveys were carried out in Korça region during the expeditions of 2020 - 2022 to collect the data about the local traditional varieties of legumes. Most of the samples were collected from farmer's field. Once the information about the cultivation area was obtained from the seed sellers, a few samples were collected from local markets as well, as information about the crops' variability could be provided. Germplasm collection is based on the recommendations in (FAO 2014). During the field survey, several accessions of different legumes were collected, and seed accessions were deposited in the Community Seed Bank in Korça and National Gene Bank in Tirana. Passport data on each accession was recorded at the time of collection, following the standard procedure. Digital photographs were taken at all landraces.

3. RESULTS AND DISCUSSIONS

Korça region is rich in agrobiodiversity, including crop landraces managed by farmers as based on their needs and adaptation properties to their growing environment in ecological key areas.

Mostly cultivated on small farms or home gardens by elderly farmers, a total of 77 germplasm accessions belonging to 10 genera and 14 crop species were collected during exploration and germplasm collection surveys (Table 1). The largest genera of the family are *Trigonella* (3 species), *Phaseolus* and *Vicia* (2 species), which are followed by *Cicer*, *Glycine*, *Lathyrus*, *Lens*, *Medicago*, *Pisum* and *Vigna* (1 species respectively). The varieties sown are landraces maintained by traditional farming practices within the traditional agroecosystem.

Table 1. List of accessions collected for each legume crop.

Category	Crop species	Common name	Local name	No. of accessions
Pulses	<i>Phaseolus vulgaris</i> L.	Common bean	Fasule	26
	<i>Phaseolus coccineus</i> L.	Runner bean	Pllaqi	8
	<i>Cicer arietinum</i> L.	Chickpea	Qiqër	5
	<i>Lens culinaris</i> Medik	Lentil	Thjerrëz	1
	<i>Lathyrus sativus</i> L.	Grass pea	Koçkull	2
	<i>Vicia ervilia</i> (L.) Willd	bitter vetch	Urov	1
Fresh legumes (vegetable)	<i>Phaseolus vulgaris</i> L.	Fresh bean	Barbunjë, mashurkë	13 11
	<i>Pisum sativum</i> L.	Green pea	Bizele	3
	<i>Vigna unguiculata</i> (L.) Walp.	Cowpea	Vinjë	1
Oilseed legumes	<i>Glycine max</i> (L.) Merr.	Soybean	Sojë	1
Spices	<i>Trigonella corniculata</i>	Cultivated fenugreek	Trendelinë	1

	<i>Trigonella caerulea</i> (L) Ser.	Blue fenugreek	Trendelinë blu	1
	<i>Trigonella foenum-graecum</i> L.	Fenugreek	Grurë Qabeje	1
Forage species	<i>Medicago sativa</i> L.	Alfalfa	Jonxhë	1
	<i>Vicia sativa</i>	Common vetch	Burxhak	1
	Total			77

Table 1 reports about the legume crop species. It could be clearly noted that pulses covered 55.84% or 43 accessions of the recorded legume landraces, followed by vegetables, oil seed crop, spices and forages covering 36.36% or 27 accessions, 1.30% or one accession, 3.90% or 3 accessions, and forages 2.60% or 2 accessions of the recorded legume landraces, respectively. The majority of legumes are cultivated for the production of dry seeds, e.g., the so-called pulses which are used for human consumption, livestock forage and silage, and as soil-enhancing green manure. However, some legumes are cultivated for fresh consumption either as pods or immature seeds. The most important legumes consumed as vegetables are green pods of common bean, cowpea, and green pea seeds and grass pea. Among the *P. vulgaris* species, frequently consumed as vegetables (pod beans or fresh beans in Korça region called *mashurka* or *barbunja*), a relatively large number of local accessions and landraces could be used as pulses. So, the division between categories is relative.

The data showed a significant diversity among the landraces of common bean and fresh bean. From a total of 77 accessions of legumes (Tab. 1), 50 belong to the *Phaseolus vulgaris* L. (26 common bean and 24 fresh bean), which shows that the areas explored are rich in genetic resources and tradition in the cultivation and use of this specie. It is the most important food legume for direct human consumption on regional scale, while runner bean has a more limited cultivation. Common bean is also the most common grain legume cultivated in the entire area as mono-cropping or intercropped with maize. Maize/climbing bean mixture is a common practice among smallholder farmers to optimize factors and environmental resources usage, thus leading to an increased yield or output of the mixture and diversity of their products. As it is quick maturing and can be easily intercropped, common bean serves as a key component for intensifying production in smallholder traditional farming systems. From this cultivation practice, some local populations of the bean are often called *fasule misri* (bean of corn). In this region, common beans are

often named according to the area of their production for example common bean *trenare*, *eçmenik*, *grapshi e shkruar*, *Kraçe e Vidohovës* etc. White runner bean is locally called *pllaqi*, or in some villages even *bakëlla*, while black runner beans are called *pllaqi e zezë* in Korça region and *barbunjë e madhe* in Kolonja. Seed accessions with heterogeneous common bean seeds with respect to seed colour need to be subjected to intensive purification into sub-groups. Of particular interest are some bushy drought-tolerant bean local varieties and with short growth cycle as *saçme*, *bean of Prespa*, *kraçe of Vidohova*, *Kosorkë* etc. They are adapted to specific local conditions e.g., non-irrigable conditions in marginal soils, and with minimal external inputs. Those short duration genotypes are believed to be very tasty by locals.

Farmers have gradually replaced landraces with the high-yielding varieties. We observed that the taste of local varieties played a significant role in the retention of these landraces by the farmers, particularly in the case of food legumes. In addition, land fragmentation would be another reason, particularly for small-scale farmers that selectively grow these landraces.

Beside common and fresh beans, other legume germplasm collected from the area include *Pisum sativum*, *Cicer arietinum*, *Vigna unguiculata*, *Lens culinaris*, *Lathyrus sativus*, *Vicia ervilia*, *Glycine max* and *Vicia sativa*. A limited accession number of another grain legume chickpea (*C. arietinum*) was also collected from farmer's field. Currently, in the Korça region, its grain flour is used for bread, while the grain is used for cooking purposes. So, the crop continues to be cultivated as farm household food, although a quite limited extend. Even though pea (*P. sativum* L.) is a legume crop that is liked and cultivated in all regions, 3 seed samples/accessions were collected from field area. Its local landraces have been replaced by modern varieties that provide higher and more consistent yield. Lentil (*L. culinaris*) is a traditional grain legume in Korça region, which is now restricted in cultivation to a small group of farmers. Only one seed samples/accessions were collected. Until the end of the twentieth century, *V. ervilia* (bitter vetch) and *L. sativus* (grass pea) have been planted for production of grain and hay in many areas of region. Nevertheless, both of species were later mostly replaced by other crops with higher and more consistent yield. Their cultivation is declining, and currently, it is being carried out by a small number of only practiced by a very small number of farmers for subsistence or traditional use only. In Korça region, only a limited number of households are historically involved in cowpea (*V. unguiculata*) and soybean (*G. max*) cultivation. So, there is a small number of local varieties being cultivated due to: i) changing land use patterns, ii) demographic changes, iii) gradual introduction of high yielding varieties, and iv) local germplasm of the aforementioned legume crop species is slowly disappearing. With seed accessions changing from village to village, it is possible that uncollected landraces still exist in other unvisited areas.

Therefore, the exploration, collection and preservation of the remaining germplasm must be done urgently.

Local landraces might have been more prevalent in the region more than 50 years ago, here we could mention the chickpea and lentil accessions, alfalfa, etc. *V. sativa* and *M. sativa* indeed represent a useful source of proteins for animal feeding as well as functional, health-promoting components. These plants cultivated on a large scale, but region is poor in their local variety.

The collection includes three genotypes of *Trigonella* (by one accession each), of which two are very rare. *T. corniculata* is the best known and most widespread species in region by this genus. Fenugreek (*T. foenum-graecum*) is a rare grain legume, known and grown by only a very few farmers for the importance of its medicinal properties. Whereas *T. caerulea* (blue fenugreek), a very rare aromatic plant, was found and recorded for the first time in Albania by us in Korça and Devoll province. The neglected and the underuse status of these crops indicates the risk of disappearance of this important plant material developed over the years in the region. The collection of National Gene bank includes only these two seed accessions of these rare species, making them among the most unique of the collection. Also, this collection has been enriched with about 75 valuable local legume accessions of Korça region.

The extensive cultivation of landrace legumes in villages and neighbouring areas shows that these landraces have been undergoing a selection process for adaptation to local climatic, edaphic, and cultural selection forces for centuries consisting of unique gene complexes reflecting local agro-climatic evolution (Al-Saady *et al.*, 2014). The regions rich in genetic biodiversity of legume crops, such as the Korça region, require community support initiatives for conservation through knowledge distribution of, publicity and cooperation with scientific researchers and governmental bodies (Jani and Miho 2016). Conservation efforts and programs can make a huge impact for local communities by incorporating community-based enterprises that will incentivize and empower individuals to protect biodiversity, support traditional ways of life, as well as help build political support for existing protected areas.

4. CONCLUSIONS

The collected 77 legume germplasm accessions belonging to 14 species of crops collected from sites across Korça region are conserved at the National Gene Bank and Korça Community Seed Bank. The common and fresh bean landraces of the region showed a high diversity. Local legume crop accessions collected are a means to address the conservation of the diversified legume germplasm, prevent them from extinction and the negative impact of the non-endemic cultivars. Genetic diversity forms would be useful to select and create

varieties with resistance traits to both biotic and abiotic factors and adverse climatic conditions for the purpose of achieving food security. Further, genetic resources support the maintenance of biological diversity, promote sustainable agricultural production, and contribute to the sustainable development and diversification of agricultural production. Keeping in view the incredible regional genetic potential, comprehensive efforts to collect the existing germplasm should be continued, which may lead to preservation of traditional varieties and neglected genetic resources, as well as in sustainable development of the region.

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