GENETIC RESOURCES DIVERSITY OF ALBANIAN DRIED LEGUMES' SEED

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ABSTRACT

Seed dried legumes are nutritional powerhouses that mankind has used since the ancient times. Over the centuries, farmers have made gradual selections of the best varieties of legumes with regard to the taste, production, and appearance. Albania is rich in natural genetic diversity of legume plants, which are cosmopolitan in distribution, representing important ecological constituents in almost all biomes across the globe and occur in even the most extreme habitats. Legume plants particularly require a warm or temperate climate. However, the great diversity of varieties and cultivars has allowed them to adapt to various climatic conditions. So, they could be found planted in the fields, hills, and mild mountains. There is a long range of local landraces and advanced varieties of legume plants playing a significant role to the growth of agricultural products and diversity of daily diets for both humans and animals. The national collection of legume plants is represented by 550 accessions of 22 species, but only 10 legume species are used as seed dried legumes for human consumption purposes. Comparison analysis found that 95% of seed dried legumes used for human consumption purposes is represented by common beans landraces (*Phaseolus* ssp.). Other seed dried legumes such as cowpeas (*Phaseolus unguiculatus*) and (*Vigna ungulata*), runner bean (*Phaseolus coccineus*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*) represent only 5% of dried legumes used as food. Spatial analysis reported that seed dried legume species are grown successfully on the low hills and mild height mountains areas of a North-West to South-East extension. Here, where excellent suitable areas range from 20 to 40%, and high suitable areas from range 10 to 20%.
***Keywords*:** Legume landraces, dried seeds, genetic diversity.

1. INTRODUCTION

Seed dried legumes are nutritional powerhouses that mankind has used since the ancient times. Over the centuries, farmers have made gradual selections of the best varieties of legumes with regard to the taste, production, and appearance. Pulses are the delicious, protein-packed, affordable and earth-friendly foods one knows as beans, chickpeas, lentils and dry peas.

Legumes are also important to the functioning of pasture ecosystems. Through a symbiotic relationship with rhizobium bacteria, legumes fix atmospheric nitrogen (N). Nitrogen fixation enables legumes to be self-sufficient for N and increases the availability of soil N (Heichel, 1985). Legume species diversity was also found to be greater on back-slope landscape positions than summit or toe-slope positions, and as legume species diversity in the pastures increased, legumes as a percentage of dry matter (DM) also increased (Harmoney *et al*., 2001).

The word "legume" is an agricultural and botanical term. In agriculture under this name are included the cultivated annual herbaceous plants which have legume fruit with seeds in different shapes, sizes, and colors. From the botanical point of view, this group includes annual and self-pollinating plants of the botanical family of legumes (*Leguminosae*). Paparisto *et. al.*, (1988) stated that the geographic position and favorable climatic conditions— from coastal subtropical to inland continental climate—make Albania rich in legumes' natural genetic diversity. There are also many other grain legume species cultivated around the world, and also many wild ones that are harvested in times of need by local people. Some of these are being investigated for their potential cultivation (Hymowitz 1990).

Seed dried beans, of different colors, are the most important pulse crops of the world, whereas chick-pea, pigeon pea, and lentils occupy the third, fourth, and sixth positions, respectively. Notwithstanding their high production potential, their productivity is generally low as these are cultivated on poor lands, with no or little inputs, and are susceptible to several abiotic and biotic stresses. Legumes are grown for since ages in different parts of the world. They are well suited to diverse environments and fit in various cropping systems owing to their wide adaptability, low input requirements, fast growth, nitrogen-fixing, and weed smothering ability. Their short growing period and photoperiod sensitivity make them suitable for crop intensification and diversification. Legumes plants are adapted to a wide range of ecological habitats in the country, in wild habitats, in forest habitats, on the hills and mountains habitats **(**Papadhopulli 1976; Salillari *et.al*., 2007). Legumes plants have a major contribution to the growth of agricultural products in all Albanian regions. There are many reasons lying in the inclusion of legumes in

the diet: i) being inexpensive, ii) having low cholesterol content and high fibre content (both soluble and insoluble), high in plant protein, are packed with micronutrients, and maintain a low-fat level. Legumes are over 90% soluble and can help manage body weight, blood sugar levels, and lower cholesterol. There are many studies proving the link between legumes consumption and reduced risk of coronary heart disease in men and women, iii) having high protein content. Protein is an essential building block for the human body. Without it, we would lose muscle mass, our metabolism would slow down, and we would feel weak and fatigued, iv) fuel of the immune system, v) being rich in fiber. Fiber acts as a cleaning and cleansing agent in our gut and intestinal tracts, vi) being environmentally friendly as meat industry is one source of greenhouse gas emissions, vii) being versatile, viii) being regulator of blood sugar as they are low on glycemic index, and ix) reducing the risk of cancer as they are rich in antioxidants. In many countries, they are part of the cultural heritage and are consumed regularly or even every day. However, these tiny legume seeds, in many shapes, colors, and sizes, have been one of the products used for food since ancient times (https://www.fao.org/fao-stories/article/en/c/1176990/). The combination in the cooking of legumes with cereals (e.g., lentils with rice) increases the protein quality of legumes. Extraction of legume extracts is used commercially to increase the value of cereal products.

Grain legumes have an impact on life on our planet. Seed dried legumes are a type of miracle plant that grows in all conditions and climates since ancient times. This group includes hearty plant species that have existed for millions of years. Legumes grow in regions with extremely hot and cold climates and are found in all four corners of the world, with the exception of poles and barren deserts. They include groups of herbaceous plants with similarities in nutritional, agronomic values, and biological characteristics but also with distinctive features that originate from the place of origin and the environment where they grow.

The National Genebank collection of legume plants is represented by 550 accessions of 22 species, but only 10 legume species, including 313 accessions of many well-known local populations, are used as seed dried legumes for human food. Comparison analysis found that about 95% of seed dried legumes used as the food was represented by common beans landraces (*Phaseolus vulgaris*). Cowpeas (*Phaseolus unguiculatus*) and (*Vigna ungulata*), runner bean (*Phaseolus coccineus*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*) represent only 5% of dried legumes used for human consumption purposes. Spatial analysis showed seed dried legume species are grown successfully on the low hills and mild height mountains areas of a North-West to South-East extension. Here, excellent suitable areas range from 20 to 40%, and high suitable areas from range 10 to 20%.

The present paper assesses the genetic diversity of the current legumes' plants, part of the Albanian National Genebank collection.

2. MATERIALS AND METHODS

Data sampling. Information on the total occurrence of legumes plant species in Albania obtained from ex-situ data collection of legumes plants stored in the Albanian genebank's database was used for the data sampling. Additional data were obtained from the EURISCO database, a web-based catalog that provides information about *ex situ* plant collections of Europe (http://eurisco.ecpgr.org), and the Global Biodiversity Information Facility (GBIF) database (Gixhari *et. al*., 2013).

Geographic distribution. The present investigation was carried out in all-natural growing areas of legumes plants in eight districts of Albania. Each population (group of individuals) represents a geo-referenced observation point. Each observation point presupposes the presence of legumes plants-or population. All geo-referenced observations (ex-situ data) chosen to carry out spatial analysis, were entered into the GIS analysis, as presence points, (Hijmans *et. al*., 2005; Hyso *et.al*., 2005) and were spatially represented as point maps using DIVA-GIS tools (Hijmans *et.al*., 2001; Hyso *et.al*., (2005).

3. RESULTS AND DISCUSSION

Analysis by geographic distribution

Significant information about each legume species has been collected and recorded. All data were checked for inconsistencies, and data points without coordinates were removed from the legumes ex-situ data. Sites with incorrect coordinates were assigned coordinates where possible, while duplicate or doubtful data were removed (Scheldeman *et al.*, 2010). In addition, all the legume species were carefully screened to resolve any scientific name conflicts (Chapman, 2005). The accessions not present physically as genetic material stored in the National Genebank were also removed.

Once the presence or absence of accessions of the data included in the legumes plants database with partial or complete information for a total of 280 presence points in total, only 210 presence points including of legumes plants were compiled and used to evaluate the geographic distribution of seed dried legumes currently observed in Albania (Figure 1).

Spatial analysis showed that seed dried legume species are grown successfully on the low hills and mild height mountains areas of a North-West to South-East extension. Here, excellent suitable areas range from 20 to 40%, and high suitable areas from range 10 to 20%.

Detailed analysis of ex situ data of seed dried legumes stored in the Albanian National Genebank show that *Phaseolus vulgaris* was represented by a higher number of local landraces distributed across the country, followed by *Cicer arietinum*, *Lens culinaris*, *Phaseolus coccineus*, *Phaseolus ungiuculatis*, and *Vigna ungulate.*

Higher number of traditional varieties (landraces) of dried legumes and especially of *Phaseolus vulgaris* populations were found in the Shkodra region, (63 populations), Elbasani region (16 populations), in Korça region (54 populations), Berati region (31 populations), and in Gjirokastra region (19 populations). Lezha, Dibra, Durrësi, and Tirana region (Figure 1) have a low number of legume populations.

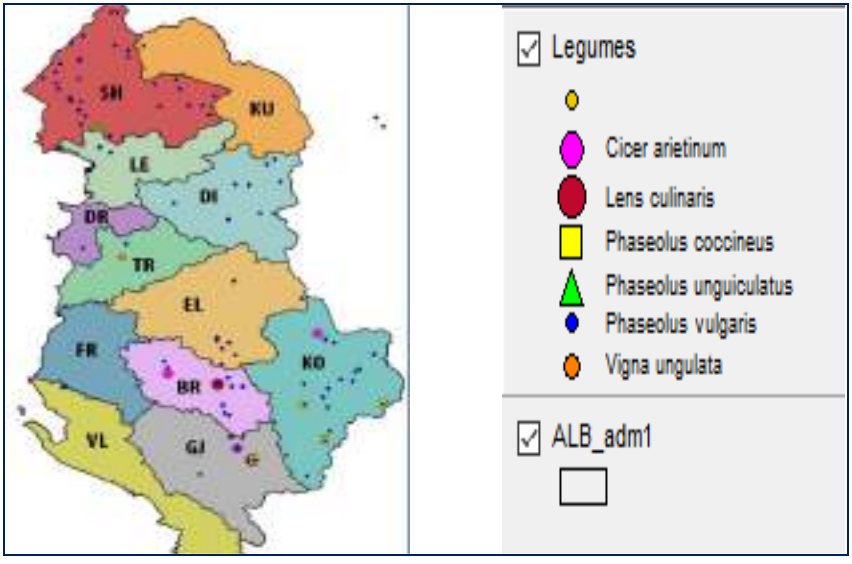

Fig. 2: Geographic distribution of seed dried legumes in 8 districts in Albania.

Analysis of seed dried legumes by species

The National Genebank stores many different samples of current and potential legumes used by breeders, farmers, seed producers, researchers, etc. All dried legume populations were collected across the country including a wide range of economically important food crops such as phaseolus, lentil, cicer, peas, peanuts etc.

Comparison analysis reported that 95% of seed dried legumes used as food is represented by common beans landraces (*Phaseolus* ssp.). Cowpeas (*Phaseolus unguiculatus*) and (*Vigna ungulata*), runner bean (*Phaseolus coccineus*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*) represent only 5% of dried legumes used for human consumption purposes (Figure 2).

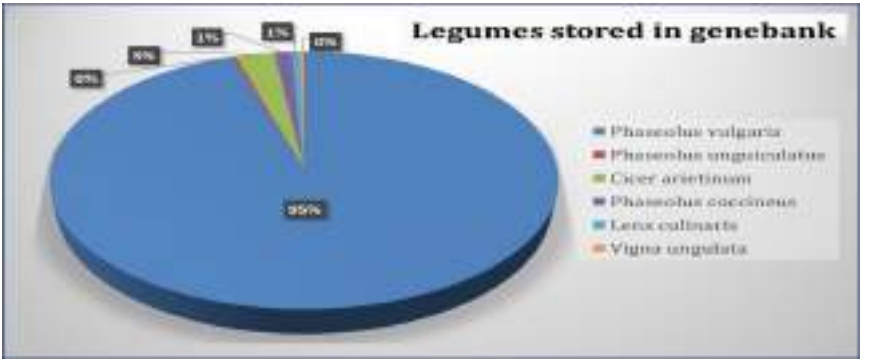

Fig. 3: Legumes stored in the Albanian National Genebank.

Collection results and acquisition of seed legumes in the Albanian National Genebank

Activities of the collection and acquisition of plant genetic resources were made from 2009 to 2016. A total of 313 accessions of 6 legume species was collected. The collected dried seeds of *Phaseolus vulgaris* were represented by more than 28 local varieties or landraces, due to climatic diversity of a great number of micro-climatic conditions of the areas. The environment has an influence on the phenotype of legumes and shape their genotypes through adaptation. *Phaseolus ungiuculatus* 1 acc., *Phaseolus coccineus* 4 acc., *Lens culinarus* 2 acc., *Cicer arietinum* 4 acc, *Vigna ungulate* 1 acc etc, were also collected **(**Table 1, Figure 3).

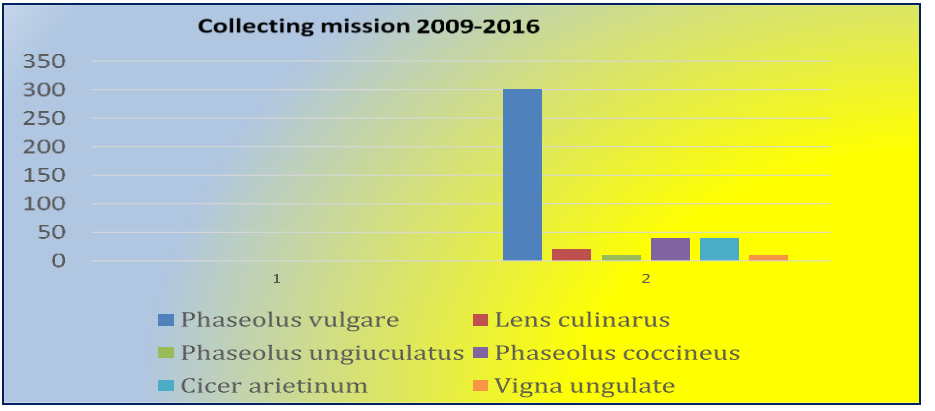

Fig. 4: Collecting results and acquisition of seed legumes in the National Genebank 2009-2016.

4. CONCLUSIONS

The following conclusions could be drawn:

i) Spatial analysis showed that seed dried legume species are grown successfully on the low hills and mild height mountains areas of a North-West to South-East extension.

ii) Albania is rich in natural genetic diversity of legume plants, which are grown over a wide range of ecological habitats in the country, on the fields, on the hills and mild height mountains habitats.

iii) Legume collections inherit a high number of local landraces and advanced varieties of legume plants (550 accessions of 22 species).

iv) Data analysis report that 95% of seed dried legumes used for human consumption food is represented by common beans landraces (*Phaseolus* ssp.).

v) Cowpeas (*Phaseolus unguiculatus*) and (*Vigna ungulata*), runner bean (*Phaseolus coccineus*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*) represent only 5% of dried legumes used as food.

vi) The principal collecting activities related to enrichment of legume germplasm were carried from 2009 to 2016. Albania is very rich in legume populations, so more collection activities must further.

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DIVA-GIS: http://www.diva-gis.org/Data

EURISCO database (http://eurisco.ecpgr.org).

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