RESEARCH ARTICLE **(Open Access)**

GEOGRAPHIC DISTRIBUTION OF FRUIT TREES DIVERSITY SURVEYED DURING FAO PROJECT

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Abstract

Study for geographic distribution of 172 geo-observations representing new accessions collected from four districts of Albania (Dibra, Korca, Gjirokastra, Shkodra) during FAO Project (2013-2014), including 9 species, was carried out, using grids of 5 x 5 km to assess the number of individuals per species and per district, the area of occupancy and diversity indices. Geospatial analysis detects areas of high alpha significant diversity. Combination of diversity indices as Species Richness, Simpson index (1–D), Shannon index, Evenness, Brillouin index, Equitability, and Fisher-alpha found the areas of Gjirokastra and Shkodra were richer in fruit trees diversity than other observed areas. Surveyed diversity of Gjirokastra and Shkodra comparable between them, was found comparable with diversity surveyed in Dibra and Korca areas, but the diversity among Dibra and Korca areas was non-comparable. Cluster analysis based on Euclidian distance(pair group method) generate a dendrogram of three clusters. Higher similarity (0.74) and significant positive correlation (r = 0.72) between diversity of Korca and Shkodra areas found. Higher species evenness > 0.78, and equitability > 87, were found in surveyed areas of Dibra and Gjirokastra Counties. These results suggest the presence of more relative stable ecosystems and more ecological niches available in Dibra and Gjirokastra areas. The diversity of these two areas could be used for the assessment of the current status of conservation of fruit tree genetic resources and for the prioritization of potential ecological areas suitable for their in situ conservation.

Keywords*:Diversity indices, geographic distribution, species evenness.*

1. Introduction

Albania is a small country located in the eastern side of the Mediterranean basin, being in the eastern part of the Balkan Peninsula. Different geological and climatic condition and the location of the country have greatly contributed to the richness of this biodiversity.

The flora of Albania is very rich in diversity (about 3250 plant species) consisting in more than 27% of European flora (Demiri 1983, Paparisto et al. 1998). Albania now possesses over 60 species and subspecies and hundreds of forms, varieties, populations and primitive landraces of endemic and sub-endemic fruit crops, that constitute the heart of the natural landscape of the country.

The information on plants biodiversity in Albania is generally lacking especially in terms of species (Gixhari et al. 2013). There is still flora, taxonomic groups, especially crop wild relatives which are unknown or have not been studied. Genetic diversity of fruit tree species and especially of farmer's cultivars is very rich in Albania. This rich diversity of cultivars and biotypes is spread out over the country and many of the cultivars are particularly well adapted to local soil and climate conditions (Gixhari et al. 2012).

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(Accepted for publication)

***ISSN**: 2218-2020, © Agricultural University of Tirana*

Geographic information systems (GIS) are useful tools for eco- geographical analysis. GIS analyses visualize biodiversity in maps, and provide important information about the diversity in specific areas. Diversity indices enable researchers to quantify diversity in a community and describe its numerical structure

2. Material and Methods

Aim of the study is to assess the geographic distribution and genetic diversity of PGR for fruit trees (in -situ & on- farm) in Dibra, Korca, Gjirokastra and Shkodra county areas.

The study for assessment of the geographic distribution and genetic diversity of fruit trees species surveyed and collected during 2013-2014 period and their contribution on the ex situ field collection of fruit tree species, was carried out. During the years 2013–2014 some expeditions prepared jointly with local experts, who provided floristic data and local information for fruit trees occurrence were undertaken in four county areas of Albania: Dibra (DI), Korca (KO), Gjirokastra (GJ) and Shkodra (SH) counties.

Each surveyed and collected plant tree species/or population represents a geo-observation, and was entered into the Geographic Information System analysis, as presence points.

The geographic areas, separated into small grid square cells of 5 x 5 km, were used to assess the geographic distribution, diversity indices, and richness estimators of plant species.

The measurement of diversity and geographic distribution was realized analyzing the number of geo-observations per species and per district and the area of occupancy by a specific species (abundance/rarity). The analysis are focuses only on the study of diversity at the species levels (unit of alpha diversity). The diversity indices as: Species richness (S), Simpson index (1–D), Shannon index (H), Evenness index (e^H/S), Brillouin index (B), Fisher's alpha index (Fα) were the diversity indices & estimators used. Diversity indices and richness estimators were calculated and mapped using DIVA – tools (Hijmans et al. 2012).

3. Results and Discussion

Collecting and quality data: Data quality of fruit tree species including the accuracy and precision of geographic coordinates of geo referenced data were checked for inconsistencies (Chapman 2005). Data points without coordinates were removed from the data. Data points with incorrect coordinates on the administrative unit (district) were assigned coordinates where possible while duplicate or doubtful data were removed (Gixhari et al.2014). After checking the presence or absence data included in the fruit tree collection database with partial or complete information only 172 ex situ presence points of 9 fruit tree species were compiled and used to evaluate distribution, diversity and the relative spatial gaps of currently fruit tree species observed and collected per each of four counties of Albania. Spatial analysis and diversity indices results detect the areas of high fruit tree species diversity (Figure 1).

Figure 1. Geographic distribution of fruit tree species collected in four county areas of Albania

Comparison of diversity indices: Comparisons of diversity indices (Table 1) show the presence of an important variability in the study areas analysed and between observed county areas related to number of individuals (presence point) and kind of plant tree species present in those geographic areas.

Species richness (S) index shows the higher number of different fruit tree species was observed in Gjirokastra, Korca and Shkodra areas (Table 1). Higher number of individuals per species (7.42 and 6.86) was found respectively at Korca and Shkodra areas, followed by Dibra areas (5.83).

The Simpson index (1 - D > 75), Shannon-Weiner index (H > 1.60), Brillouin index (B > 2:00) and Fisher index alpha (Fα > 10:00) indicate the presence high diversity of fruit tree species in the county areas of Gjirokastra followed by diversity of areas of Shkodra and Korca counties.

Table 1. Comparison of diversity indices according to 4 county areas of country.

Indices / County	Dibra	Shkodra	Korca	Gjirokastra
Taxa_S	6	7	7	8
Individuals	35	48	52	37
Simpson_1-D	0.751	0.7891	0.7359	0.8108
Shannon_H	1.566	1.662	1.53	1.835
Brillouin	1.351	1.473	1.359	1.567
Evenness_e^H/S	0.7977	0.753	0.6597	0.7831
Equitability_J	0.8739	0.8542	0.7862	0.8824
Fisher_alpha	2.084	2.255	2.178	3.139

In the Gjirokastra county areas higher number of different species was found and the number of individuals distributed among species were more even (0.783) and equitable (0.882). High evenness (0.798) and equitability (0.874) was also observed in the Dibra areas. In this study the Shannon index values ranges from 1.530 (Korca areas) to 1.835 (Gjirokastra areas) showing in general presence of mid species richness and evenness. Evenness (e^H/S), and Equitability (J) shows the higher evenness and variation in populations between the species, occurs in Dibra, Gjirokastra and Shkodra areas (Table 1). Comparison of diversity indices suggests Gjirokastra and Dibra county areas present more relative stable ecosystems and ecological niches. In these areas a greater number of different species important for conservation should be still available in the future.

Comparison of diversity profiles: Diversity profiles analysis dependent upon a single continuous parameter alpha, show the diversities among Gjirokastra (blue light line) and Shkodra (blue dark line) are comparable. But the diversity among Dibra and Korca county areas (where green line cross red line) are non-comparable among them (Table 1, Figure 2).

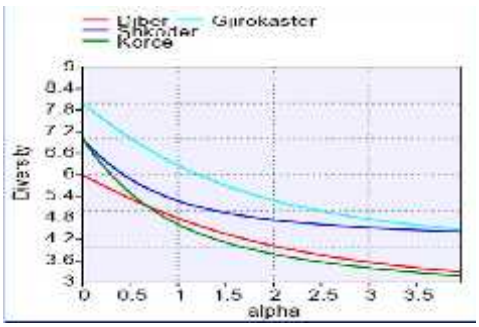

Figure 2. Diversity profile among Dibra, Shkodra, Korca and Gjirokastra county areas

Cluster analysis: Comparisons of diversity indices (Table 1) using cluster analysis based on Euclidian distance (pair group method) generate a dendrogram with three clusters.

Cluster analysis based in Euclidian distance on correlation found higher similarity (ED = 0.74) between Korca and Shkodra areas. Strong significant positive correlation (r = 0.72*) has resulted among diversity of Korca and Shkodra areas. There were positive correlations between all four county areas surveyed and collected, but higher positive correlation was also found among Gjirokastra and Korca areas (r = 0.89) (Table 2).

Figure 3. Dendrogram of similarity (Euclidian distance) among four counties of Albania

Table 2. Correlation matrix between four county areas observed in Albania.

	Dibra	Shkodra	Korca	Gjirokastra
Dibra	1	*	*	*
Shkodra	0.3467	1	*	*
Korca	0.4948	**0.7252**	1	*
Gjirokastra	0.5367	0.6867	**0.8952**	1

The geographic distribution of fruit tree species diversity study proved important information about the diversity present in the four specific geographic areas of Albania. Results of this study, congruent with results of Guarino et al., (2002); Parra-Quijano et al., (2012); Gixhari et al., (2014); suggest that the ecological areas of Gjirokastra can be used for the assessment of the current conservation status of plant genetic resources and for the prioritization of potential ecological areas suitable for in situ conservation

4. Conclusions

- Spatial analysis found significant differences of diversity between observed areas, and detects the area of high (alpha) was Gjirokastra county, followed by Shkodra areas.
- The diversity observed in Gjirokastra was comparable with diversity observed in Shkodra areas, but the diversity among Dibra and Korca county areas were non-comparable.
- The results of the study suggest the ecological areas of Gjirokastra can be used for the assessment of the current status of genetic resources conservation and for the prioritization of potential ecological areas suitable for in situ conservation.
- Spatial analysis can be used successfully to estimate genetic, species and ecosystem diversity of different regions.

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