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Old Olive Inventory in Adriatic and Ionian Coast of Albania

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A B S T R A C T

The study of genetic material for the indigenous populations of olive was conducted following the 450 km of longitude of the Adriatic and Ionian coast. The method consisted through a questionnaire and the physical exploration of the territory, to find; Mild olive and wild olive very old. In every hearth were inspected the trees centuries by way trees by tree and was identified for her state: varieties, forms, biotype and wild olive. Results proved that actually are identified 176 accessions centuries. There are three very old "mother" populations that characterize very close connection with the geography of their cultivation: Population of wild olive, Population of Kaninjot and White olives. According to thermal and biological constants, these resources have been localized with a great density in two main Mediterranean hearths of Ionian and Adriatic influence. Generally, varieties have more heterogeneous population, noting that wild olive resources result in serious risk of extinction in many provinces. In conclusion, the olive grove expresses the effects of biodiversity, erosion of diversity and biodiversity impacts on olive grove of our country.

Introduction

Ionian and Adriatic coast and up to 100 km inland up to all areas with Mediterranean climate. Olive has always been the basic direction or foundation for agricultural systems of governments, as an economic, social and cultural factor. In the social plan, olive grove has reduced rural exodus, being an index of prosperity and civilization.

The presence of the wild olive in Albania was identified 12.000 years ago, but according to some authors, the olive is in Mediterranean basin more than 40 thousand years, Frezzoti, *et al.*, (1978); Bartolini, (2006); Ismaili, (2016); Zhan, *et al.*, (2015). Diversity in the family of species, between species, and between ecosystems, is considerably transformed under the influence of human activities, Ismaili, *et al.*, (2013).

Olive varieties are necessary to maintain the functions as an integral part of the structure and ecosystem processes (Baldini, *et al.*, 1955). Are those the reasons that people insist to select suitable varieties for their needs to respond to typical environment conditions, and thus have created a very rich

diversity, Bottari, *et al.,* (1952). Olive resources are of great interest, because protect the environment and the study of their diversity helps to find links within each ecosystem, Velitzelos, *et al.,* (2005).

Olive groves of Albania lies on the eastern shore of the Mediterranean and is considered as an important point for biological diversity because is part of the fifth center's with Mediterranean climate origin and formative of cultivated plants. Researches on resource management, study and their improvement are priority activities and have scientific and economic character of national importance, Damigella, (1960). A country cannot guarantee its future without a rich resources world, with high efficiency and quality. The aim was to avoid genetic erosion favored by the abandonment of agriculture in the tourist area of this dissemination areal. This study carried out the analysis of the diversity in correlation with geographical distribution and accessions localization in the Ionian Sea and the coast of the Adriatic.

Materials and Methods

Principal Terms for exploration: From 2009 to 2015, old individuals of the mild and wild olive were explored, inventoried and collected all over the territory of the olive groves.

First: Through to the questionnaire seeking information on some main characters (a) Mild and wild olive very old (b) Tree that change from population for fruit and leaf shape. (iii) Old trees, more resistant to the main disease, cycloconium oleaginoum.

Secondly: Physical exploration of the territory. On the map Adriatic and Ionian area are assigned eight older plantations. In every hearth were inspected the trees centuries by way trees by tree: Each tree was identified for her state: mild and wild varieties, forms and biotype.

Third: Sampling, accepting and analyzing conform PCA terms for six key features possessors of variability. (i) Neck circumference of the trunk. (ii) Fruit; average weight, shape and symmetry. (iii) Endocarp average weight, shape and symmetry (IV) Leaf, surface, weight, shape and symmetry. (v) The content of oil (vi) Resistance to disease. Accessions were analyzed for the main organs according to IRGB standard, Cantini, *et al.,* (1999).

Diversity Analysis

The genotypes were analyzed for their diversity, taxonomic and biometric values, Caballero, *et al.,* (1986); Fabbri, *et al.,* (1995). Based on the biological constants the map of the distribution of both species was modeled through Bioclim/method modeling. The main hotbeds of diversity between the Olea europaea ssp.s ativa, oleaster and sylvestris were assessed and defined through the coefficient of diversity and genetic wealth, Baldini, *et al.,* (1955).

Analysis for age, location, taxonomic values and biometric analysis and valence liaison with topographical and geographical elements have determined the correlation coefficient, genetic diversity and richness projections of relief. The main valence, which are analyzed are: Light, temperature, geographical, Diversity, Humidity-edaphic, Air humidity, Morphological index. NEH-index, Margalef Index, Richness index, Menhinick index (Diva-GIs' modeling); Ribeiro, *et al.,* (2013); Cantini, *et al.,* (2000); Copen, (1923).

Statistical Analysis

Descriptive statistics were calculated within and among accessions, with univariate, F-

test for the distinctions. Variability was tested for each character with: tukey-kramer, Principal component analysis (PCA) was carried out for all possible couples of the variables, for the determination of the possessive components of the variables. Cluster average linkage method, analyzed and took into consideration the characteristics of each character JMP, S.A.S (2008); Diva-Gis. (2008): Cantini, *et al.*, (2000).

Results and Discussion

Environmental factors: Albania is part of the subtropical belt and included in the Mediterranean climate zone, Ismaili *et al.*, (2013); Figure 6.

Olive geographical distribution is not occasional but is a function of the action to more climate factors who conditional phonological stages following the annual cycle of the tree. Among the factors, the temperature is particularly important because it is the first parametric for regulating the geographical distribution of species of olive. In optimal availability conditions hydrological and the energy it exercises an incalculable influence in the intensity of many physiological processes. By thermal and biological constants, these resources have been localized with a great density in two main Mediterranean hotbeds: area of Ionian influence and of Adriatic influence, Figure 6; Copen, (1923). The climate variation value between the two areas is an average big cv = 18%. On the first is collected 28400C, while in the second hearth 23200C. Solar lighting ranges from 2731 hours per year in Saranda, 2722 hours per year in Vlore and 2389 in Shkoder. Variety is in strong connection with climate elements (r=0.98), because the temperature is the main parameter which is limiting or evaluative. Besides this element are important the energy availability and water. In this way the amount of environmental impact on the performance of phenotype is equal to with connections genotype - environment and their biological interactions.

The olive populations: Albania has a high genetic wealth. In table 2, explorations in the realm of olive expansion have enabled the identification of 176 old accessions, in two major populations: Soft populations (Olea europaea L. subsp. sativa) and wild population (subsp. Oleaster, sylvestris, and Cuspidata), which possess a greater genetic diversity, composed all cultivated varieties and wild polymorphisms of which is different.

Genetic wealth in Ionic hearth is 107 accessions, analyzed the correlation with margalel and menhinick index that means higher genetic density versus territorial unit a high correlation coefficient and great match. The accessions of each subspecies are characterized by a typical microclimate, thus the diversity of the wild accessions was localized on two main hotbeds. The wild accessions were found in certain environmental conditions, in reciprocal collaboration among solar radiation with a lot of typical effective temperatures, latitude and terrestrial elements Velitzelos, *et al.*, (2005). the oleasters result to be widespread and lie in the territory of both hotbeds whereas the wild olives are localized 91.3% in the Ionian hotbeds which are shown in figure 6.

In figure 6, the bioclimogramic map shows that 37.5% of the surface is excellent for the growth of the olive, whereas 17.6% of the territory is considered inappropriate. The coefficient of the variation of the oleasters in both hotbeds is 66.3%. Diversity in the Ionian hotbeds possesses a higher genetic

wealth density and has a high value of this coefficient, figure-6.

Olive genetic populations are the entirety of individuals who express a variety of genetic proximity, as a result of sexual reproduction and breeding in limited geographical areas. In general they keep and inherit their traits. Isolation in certain geographical areas has prevented individual's intersection with other varieties. Such cases have the population of cv. Kaninjot which is kept clean for many centuries. For example, population of "White of Tirana", "Kryps of Berat", "Kryps of Elbasan" etc. Another characteristic are some population's areas, there have been no exit of individuals and entry of foreign individuals and in those cases have been enclosure populations such as the case of population "Himara" etc.

Ancient olive populations have had different sizes. The number of individuals inside each population represents the population size. The entirety of genes inside the population comprises the diversity size. In general is concluded that, old plantations have had a relatively stable genetic complex from which follows the centuries have been created and are born individual genotype. Under the influence of natural selection and human domestic pressure has come in to relentless progress the addition of accessions density with economic advantages and accession reducing in low values within each older population. Population density of ancient olive is expressed with the relative eventuality of its individuals. The entirety of accessions of a variety and in a given population constitutes the genetic fund. Judged on the methods basis of statistical analysis are verified genetic composition of populations and their changing dynamics. In these circumstances varietal populations are classified: "Mother" population, very old and very important because together occupy about 70% of the surface, and small populations which occupy the rest of the surface and may extend within the mother populations.

"Mother" Population, are determined three. In the first group: the population of wild olive. Secondly: Population of Kaninjot olive. Third: Population of White olives.
According to another analysis based on Correlates of biological constants subspecies, elements of climate, soil and geographical position were analyzed and is estimated the coefficient of diversity, genetic wealth and regionalization of the subspecies on the territory, Figure 6. From this point of view besides olive wild population, there are two very old "mother" populations that characterize very close connection with the geography of their cultivation:

Population of white olive in the Adriatic cultivation area and population of Kaninjot olive in the Ionian cultivation area.

The concept of the term for the cultivated types is "cultivar" but the more acceptable term to all types is 'Variety'. Many varieties represent a very large variability, which are seriously subject of the botanical judgment of the word variety. The universe of current varieties has a sexual reproductive activity origin of olive following the domestic improvement, under selective pressure for human use. Thus, varieties of interest for the production of olives and oil are multiplied and increased, while varieties with not god features are abandoned or forgotten.

Referring to table-2, olive genetic fund consisting of Olea europaea L. subsp. Sativa 124 accessions, Olea europaea L. subsp. sylvestris 8 accessions and Olea europaea L. subsp. Oleaster 24 accessions have local designations in composition of two spots.

The labels sources are from the destination of use, the characteristics of the fruit, the name of the country of cultivation, the botanical origin etc. According to the above analysis accessions explored are grouped into four groups: Old variety: Olive varieties are revealed domestic when the mankind started to select and multiply the trees that gave them pleasure. Biotypes are considered special individuals who have small populations. Forms are individuals who derive from different varietal population but have variations important for differentiated quality features. Clones derive from clonal selections, certificated in the morphological and molecular plan for genetic variation. 140 accessions were collected in "in situ" while 56 more important accessions are collected "ex situ", table 2.

Olive fund analyzed on the principal terms of exploration and collecting has three strong terms in PC1, (WS, SL, O) which have possessed 70.3% of the general variability. Whereas the PC2 is a trait proprietor that together PC1 + PC2, they have possessed 87.8%. Accessions according to analysis are polarized into three spaces, within which is Kaninjot population, white olive and in negative space are wild olives. While the forms and biotypes they are out of three populations, Figure 4. While in Figure 5, by Cluster analysis of morphological similarity is the index of précis similarity (IPS) for all individuals (0.023). Through this index, olive main fund is classified into two main groups and six sub groups. The morphological frequencies varied within a wide range, from 0.0 up to 0.91, some accessions have great similarity and constitute morphologic synonymy, some accessions which comprise a specific profile. Morphological similarity average is 19.7% according to figure 5.

Through clustering software, implemented with possessor features, has shown a good effect for the classification of resources very old. The analysis confirmed the three population groups: Ionian area with 107 accessions, Adriatic area (69) accessions identified as variety, biotype and forms with consistent distribution of genetic frequencies.

On the other hand, this analysis showed that, accessions were in groups according to their characteristics; Table, oil, oleaster. Has some specific accessions, which are created as a result of displacement and evolution of genetic equilibrium of these "mother" populations"

Involuntary plant material displacement and geographic impact have predisposed that the populations differ more from each other, and their reproductions have created new homogeneous population, Ismaili *et al.*, (2013). On the other hand the different genotypes within a population have vital qualities and different fertility. This has led to reduce through selection the genotypes with no good quality and the more suitable to multiply quickly. Consequently, the probability of two mother accessions, to give off spring has been with coefficient value match very high and stable over time. From the standpoint of stability and expediency in the sativa subspecies family; white and Kaninjot olives are the elderly. Naturally, these were the source of genetic diversity olea europaea L. olive subsp.sativa in Albania.

In the wild olives group have been explored two sub groups: Wild olive or "argelidhe" subsp. Sylvestris, which are characterized in the form of barbed bushes and the fruit, is very small. Have small leaves, small fruit with big endocarp, very short inter-junction. Generally found in a spontaneously form out and within the olive groves in the south of the country and secondly olivaster, Subsp.

oleaster, which differ for many features with wild olive, because fruits resemble the cultivated forms, have higher weight, have sprig with longer inter-junction, usually do not have thorns. Their fruits are used for oil industry and the seeds for sprouting production necessary for the production of seedlings, Table 2.

The olive wealth; Judging on spontaneous diffusion of oleasters and individuals which are aged over 30 centuries, variability in varietal populations, oil mills and evidence of ancient culture, etc. figure-3. Make our country to have two main hotbeds of olive diversity:

(i) Ionic diversity hearth lies in the south of Seman River. This is characterized by Kaninjot population.

(ii)Adriatic diversity hearth. Includes territories under Adriatic climate in the central part of Berat up to Koplik to the extremes where is felt the seaside impact. This has the characteristic and the main population of white olive.

Table.2 The Olive Indigenous Genetic Fund Explored and Collected in Adriatic and Ionian Coast of Albania

Conservation status ***Classification***	Explored Inventory		Collected in situ	Collected ex situ
	Ionian area	Adriatic area		
Subsp.sativa	79	45	94	45
Subsp.oleaster Hoffmans	10	14	13	3
Subsp. Sylvestris Mill.	8	-	4	-
Subsp. Cuspidate	1	-	1	-
Forms	2	4	4	-
Biotypes	2	3	5	-
Clone	5	3	8	8
Total	107	69	140	56

Fig.1 Map of Adriatic and Ionian Coast of Olive Cultivation in Albania

Fig.3 Dajti and Petrel Olive. Neck circumference of the trunk is 28 and 36 m. They are estimated around 3000 and 3500 years. These are testimonies of Ancient Tree, Civilization and Albanian Cultures

Fig.4 Principal Coordinates Analysis (pca) Plots of the Olive Accessions based on the First Two Principal Coordinates (positive and negative). Legend: pop: Population, cl: Clone, f: Forms, b: Biotypes,

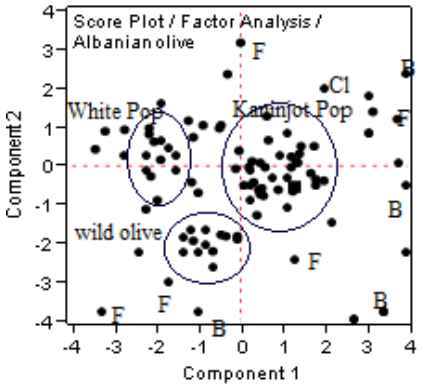


Fig.5 Hierarchical Clustering Method Ward, The Similarity Analysis for Principal Accessions of Olive, based on the Main Features defining the Similarity.

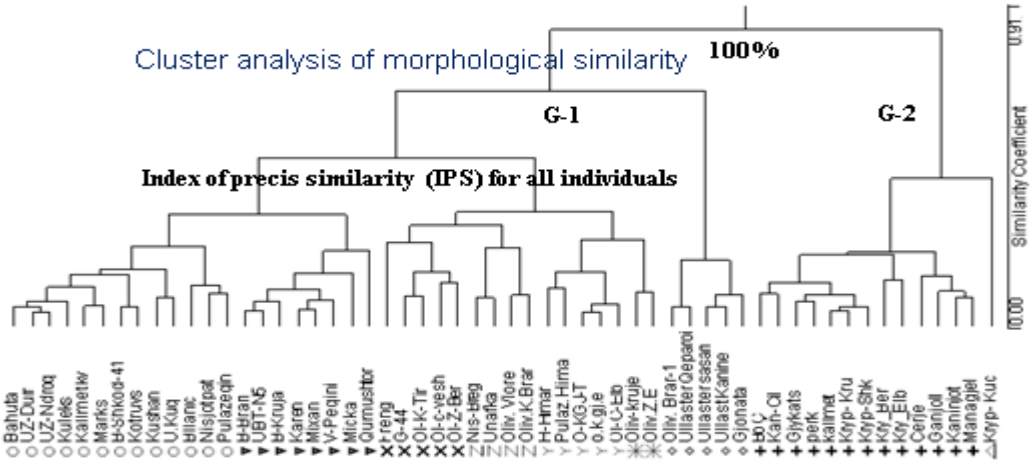
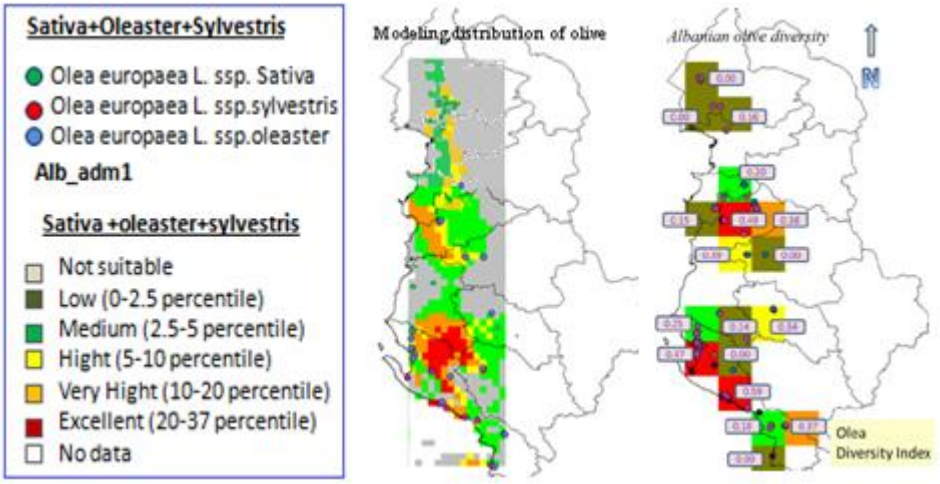


Fig.6 The Distribution of Three Species for the Diversity and Richness Coefficient Realized for Indigenous Genetic Fund on Diva-Gis (Bioclim/Domain) and in the Analysis of Biological Development Valences is Seen the Level of Suitability of the Three Sub Olive Species in Territory.



Referring the dendograme 6, olea diversity index, the two hearths have great and distinct diversity. Many genotypes are cultivated and have economic significance, while there is another fund, of wild species with genetic proximity to those cultivated. Also, there species and old cultivars, that are grouped in small hearths and continue to be cultivated as a result of greater adaptation.

In dendrograme 6, Olea richness following the ages they are constantly changing, and as a result of natural selection indigenous varieties now occupy 90% of the total surface, while about 10% are foreign cultivars. From all this biological diversity only a small number of cultivars and species of the country has economic value and meet food needs in centuries. . Figure-6, The distribution of three species for the diversity and richness coefficient realized for indigenous genetic fund on DIVA-GIS (Bioclim/Domain) and in the analysis of biological development valences is seen the level of suitability of the three sub olive species in territory.

Generally it resulted that Genotypes in origin area have the typical population and different size. In each hearth the density indicator has changes. Southern Hearth is characterized for higher resources density estimated for the number of genotypes and possession areal. Referring to the possession areal, are three very rich micro-hearths referred to Olea diversity index, figure 6. In the center is a diversity epicenter with diversity index 0.49, very rich. While in the Ionian hearth there are two diversity epicenters which correspond to Ionic coast with index 0.59 has a richer olive diversity and in centuries olive grove around the city of Vlora with diversity index 0, 47.

Genotype diversity of origin proves the connections that exist between olive grove and biodiversity. In particular, they express olive grove effects on biodiversity, erosion of diversity, agricultural practices favorable to biodiversity and on the other hand, services and biodiversity impacts on olive grove of our country. From this point of view wild olive resources result in serious

risk of extinction in many provinces. Therefore they should be explored and studied prior to suffer a bad luck either for urbanization causes or because of substitution and creating new blocks with soft forms or introduced from the outside.

Genotypes are found in the mutual interaction between solar radiation, latitude and terrestrial elements. They have biological requirement for the average high temperature and are characterized by appropriate microclimate therefore, the diversity of wild genotypes is localizes in two main hearths. Oleasters result in wider distribution and are extended in the territories of the two hearths and, sylvestris are located 91.3% in Ionic hearth. In figure-6 reflected through the Bioclim / Domain, 20-37% of the surface reflects excellent growth and development of Olea europaea sativa, oleasters and wild olive. High adaptability to very high 15-30% of the territory, 2.5-5% with average adjustment, while 0-2.5% lower, considered inappropriate 26.5-38% of the territory lying in two homes development. On this context, the genotypes of the subspecies are characterized by thermal constants of different biological indices and there are strong correlations between the age of genotypes and climate (r^2= 0.77-0.94). An indicator of suitability is the old age of genotypes which goes from 800 to 3000 years old, figure-3. The coefficient of oleasters variation in the two hearths is 66.3%. Diversity in the Ionian hearth possesses the highest genetic density wealth than in the Adriatic area. In this point of view, subsp. sativa and subsp. Oleaster, have high adaptability in the territory and are regionalized in two olive diversity hearths. While wild olive subsp. Sylvestris is massively spread in the Ionian hearth area that is characterized by higher average temperatures compared to the Adriatic hearth. Thus is verified that sylvestris group varieties are susceptible to cold than subsp. sativa and oleasters.

In general, it results a key conclusion because the presence of oleasters with homogeneous distribution in populations of domesticated olive is positive and has influenced especially for increasing the frequency of pollination and fruit connection. In a sense other varieties are domesticated of these sub species.

In Conclusion, the data obtained through the explorations were corresponded to the archaeological data in response to the requirements for the characterization of the autochthonous resources, origin and Albanian culture of the olive.

The olive Indigenous genetic fund explored and collected in Adriatic and Ionian coast of Albania are rich and they are used for long periods. In conclusion, they have proved their great importance for the Albanian agricultural system in rural plan, social, economic and cultural.

In particular, they express olive grove effects on biodiversity, erosion of diversity, agricultural practices favorable to biodiversity and on the other hand services and biodiversity impacts on olive grove of our country. From this point of view generally wild olive resources result in serious risk of extinction in many provinces.

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